FEB 28 1929

VOLUME 1 NUMBER 2

ARCHIVES OF OPHTHALMOLOGY

Continuing the Publication
FOUNDED BY HERMAN KNAPP, 1869

EDITORIAL BOARD

ARNOLD KNAPP, New York
WILLIAM ZENTMAYER, Philadelphia SANFORD R. GIFFORD, Omaha
GEORGE S. DERBY, Boston FRANCIS HEED ADLER, Philadelphia
JOHN HERBERT WAITE, Boston

FEBRUARY, 1929

PUBLISHED MONTHLY BY AMERICAN MEDICAL ASSOCIATION, 535 NORTH DEARBORN STREET, CHICAGO, ILLINOIS. ANNUAL SUBSCRIPTION, $8.00

Entered as Second-Class Matter, Feb. 7, 1929, at the Postoffice at Chicago, Illinois, under the Act of March 3, 1879.

CONTENTS OF PREVIOUS NUMBER

JANUARY 1929, NUMBER 1

Meningiomas Arising from the Tuberculum Sellae with the Syndrome of Primary Optic Atrophy and Bitemporal Field Defects Combined with a Normal Sella Turcica in a Middle-Aged Person. (To be continued.) Harvey Cushing, M.D., and Louise Eisenhardt, M.D., Boston.

Diseases of the Eye in Old Age. W. H. Wilmer, M.D., LL.D., Sc.D., Baltimore.

Histologic Observations in a Case of Localized Tuberculous Chorioretinitis. F. H. Verhoeff, M.D., Boston.

Iridectomy in Glaucoma: A Study of the Glaucomatous Process. Albrecht von Graefe, Berlin, Germany.

Ulceration of the Sclera. H. R. Dunnell, M.D., St. Louis.

Ophthalmologic Review:
The Entoptic Visibility of the Capillary Circulation in the Retina. Francis Reed Adler, Philadelphia.

Correspondence:
Benevenuto Grassi's "De Oculis." Casey A. Wood, M.D., Stanford University, Calif.

Notes and News

Abstracts from Current Literature.

Society Transactions:
American Academy of Ophthalmology and Otolaryngology.
French Society of Ophthalmology

Book Reviews.

Directory of Ophthalmologic and Otolaryngologic Societies.

ARCHIVES of OPHTHALMOLOGY

Volume 1 (old series Volume 58) FEBRUARY, 1929 Number 2

THE NUTRITION OF THE LENS AND OF THE VITREOUS*

HENRY SMITH, C.I.E.

Lieutenant-Colonel, Indian Medical Service (Retired)

SIDCUP, KENT, ENGLAND

I use an analogy as introduction, to which I shall appeal later:

What are the functions of the rhythmic contractions of the uterus during pregnancy? It is granted that these exist and are so marked in twin pregnancies as to cause oppressive flushing of the face in the later months. A number of crude mechanical theories with unsound bases have been advanced as explanations. My explanation has, I think, not been advanced by any one else.

A limiting membrane separates the placental sinuses from the uterine sinuses. Through this limiting membrane, the nutrition of the fetus passes in, and the waste passes out. The nutrition is presented on the outside of this membrane by the blood stream in the uterine sinuses. Considering the small area of the inlet arteries and the vast area of the sinuses, the force conveyed from the heart has not enough power to drive the blood forward into the veins. The uterine contractions come into play, pressing the blood between the relatively incompressible fetal sac and the muscular wall periodically and driving it forward into the venous circulation—hence, the observed periodic flushing. This mechanism, under the control of the nervous system, periodically fills up the sinuses, leaves the blood long enough in contact with the membrane to become deoxygenated and to take over carbon dioxide and carbon, and then flushes it on. The contractions are thus, respiratory and nutritional, and on them the life of the fetus depends.

In the case of the eye, the lens and vitreous are enclosed, each, in its limiting membrane. The nutrient medium for both, I think all agree, is the aqueous humor, to which the limiting membranes are exposed; also, the aqueous is secreted by the glandlike cells of the ciliary body. Theorists, of course, dispute whether this secretion is the result of osmotic action, or whether it is a true secretion as bile is a true secretion. I hold the view that it is a true secretion. This theory admits of the mechanism going out of order, thus supplying a pathologic pabulum and causing disease, which it is known does occur. The osmotic view would

* Submitted for publication, Oct. 29, 1928.

* Presented before the Oxford Ophthalmological Congress, July, 1928.

necessitate constancy in composition and, hence, exclude nutritional disease, apart from the fact that it would not provide a specialized pabulum. There is no reason why the lens and vitreous would not take their requirements from the aqueous and give back their waste to it through their limiting membranes in the same manner as the fetus does to the blood in the uterine sinuses.

This method of nutrition requires a regular circulation of the aqueous. The so-called pumplike mechanism was clearly demonstrated by Professor Thompson—muscular fibers of the ciliary body acting on the scleral spur and through it on contraction, drawing open the slitlike opening of the canal of Schlemm and, on relaxation, permitting it to fall together like a valve. I prefer the term "sluicelike" action. In principle, its action should be periodic to be economic, allowing the nutrient medium a certain time for diffusion, and then passing it on and admitting a fresh supply which would be provided by the sluicelike action, under the control of the nervous system.

I hold that both senile cataract and glaucoma are due to starvation which results because the mechanism that secretes the special necessary pabulum has gone out of order and thus supplies a pabulum which is not physiologic. I have demonstrated in a number of papers that an intense hyperemia induced over the ciliary region reestablishes the function of that mechanism, as evidenced by the clearing up of the lens in the early stage of cataract. I hold that glaucoma is due to a different disorder of the function of the secreting mechanism, which causes it to supply a pabulum that induces edema of the vitreous; this in turn presses forward the structures in front of it, and thus puts the sluicelike mechanism out of order; hence, intra-ocular tension results. If this tension is not controlled, it dominates all other factors. At present, the treatment for glaucoma is treatment for the one symptom of pressure, and it is not aimed at anything else. In practice, it is fairly successful; what is its real though not recognized rationale? The organism in health secretes against a pressure of approximately 20 mm. of mercury. An iridectomy or trephining reduces the tension much below normal for a number of days, by propping open an artificial sluice-gate. Nature endeavors to put up normal tension and cannot do it. Hence, there is an enormously increased secretion of aqueous, which implies the induction of an intra-ocular hyperemia of the secreting mechanism, which, in turn, reestablishes its physiologic condition. This view, if accepted, would alter fundamentally the conception of glaucoma and its treatment. A mechanical drain for the performance of a physiologic function does not appeal to me—a filtering cicatric, so called. If it is too large, the eye is soft; if too small, the eye is hard. Means of determining the exact size which will maintain physiologic tension are

not available. I hold that when iridectomy or trephining is successful, it merely acts until the physiologic equilibrium of the nutrient mechanism has become reestablished, after which it does not have any *raison d'être*.

The foregoing view might imply in glaucoma the induction of an intense hyperemia over the ciliary region, the tension being controlled as often as necessary by tapping of the anterior chamber until equilibrium is reestablished.

I now suggest to ophthalmologists who are in a position to do so to make (1) a careful record of the pulsations of the aqueous, if any, which should be compared with the cardiac pulsations; (2) a careful analysis of the aqueous in health, and (3) a careful analysis of the aqueous in the early and immature stages of cataract, and in acute and chronic glaucoma, in the living subject—the pathology of the living person—which can be done without the slightest risk to the patient.

CYST OF THE UVEAL LAYER OF THE IRIS AT THE PUPILLARY MARGIN

IN A CASE OF POSTERIOR SYNECHIAE WITH SECONDARY GLAUCOMA *

W. H. WILMER, M.D.
BALTIMORE

In 1889, Hulke [1] described nineteen cases of cyst of the iris. Two of these involved the uveal layer. In the case quoted from Wharton Jones,[2] a delicate cyst protruded from the posterior into the anterior chamber. It followed a penetrating wound of the cornea received a year and a half before. In another case, quoted from Bosteels,[3] a history of previous injury or inflammation was not obtained, the duration was probably about eighteen months, and the cyst was opaque and brown, while the iris was blue.

In 1892, Greeff [4] reported a case of cyst of the iris lined by pigment epithelium, which occurred after the extraction of a cataract. The eye was removed because of iridocyclitis, and the cyst was examined microscopically.

In 1893, Collins [5] reported nine cases of cyst of the iris. Among them, three involved the pigment layer of the iris. One of these followed an injury from scissors. The vision was reduced to light perception; there were posterior synechiae, and the intra-ocular tension was increased. In describing the microscopic appearance of the cyst, Collins said: "That the separation of the two layers should become so extensive as to give rise to the appearance of a tumor, has not, I think, before been suggested." The second case followed an injury from a piece of wood; but the third differed from all the others in that there was not any history of a previous injury or inflammation. In this instance, it

* Submitted for publication, Oct. 29, 1928.

* From the Johns Hopkins Hospital, Wilmer Institute.

* Read before the American Ophthalmological Society, Washington, D. C., May 1, 1928.

1. Hulke, J. W.: Report on Cases of Cysts of the Iris, Roy. Lond. Ophth. Hosp. Rep. **6**:12, 1869.

2. Jones, Wharton: Case of a Cyst Filled with Watery Fluid Projecting into the Anterior Chamber of the Eye, Lancet, 1852, p. 269.

3. Bosteels: Observation d'un kyste de l'iris, Ann. Soc. de méd. d'Anvers **25**:425, 1864.

4. Greeff, R.: Zur Kenntniss der intraocularen Cysten, Arch. f. Augenh. **25**:395, 1892.

5. Collins, E.: On the Pathology of Intraocular Cysts, Roy. Lond. Ophth. Hosp. Rep. **13**:41, 1893.

Fig. 1.—Uveitis, posterior synechiae and glaucoma. Cyst of the uveal layer of the iris. Tension, 43 mm. of mercury (Schiotz).

Fig. 2.—Collapsed cyst after sclerocorneal trephinement. Tension, 13 mm. of mercury (Schiotz).

UNIV. OF MICH.

was necessary to perform an iridectomy, with the removal of the dark mass, in order to establish a correct diagnosis and to differentiate between a melanotic growth and a cyst.

In 1893, Eales and Sinclair [6] reported two cases of uveal cysts of the iris, each of which followed an injury. In the second case, owing to an occluded pupil, the cyst was not discovered until after enucleation. In discussing this paper, Collins said: "It was quite common to find pathologically, in eyes with old inflammatory trouble, separation of the two layers at the back of the iris, the posterior being glued down to the lens, whilst the anterior and stroma of the iris were pressed forward." He mentioned the exceptional nature of the so-called spontaneous pigmented cyst.

In 1904, Schieck [7] called attention to the difficulty in distinguishing between a melanosarcoma and a dark, pigmented cyst of the uveal layer. At that time, he stated that melanosarcoma of the uveal tract was more common statistically than cyst. He reported two pigmented cysts of the posterior layer of the iris. In the first case, the eye was enucleated because of the diagnosis of melanosarcoma. In the second case, the eye was removed because of "phthisis dolorosa," and the discovery of the cyst was incidental.

In 1908, Coats [8] reported "An Unusual Form of Cyst of the Iris." The eye was removed under the impression that there was a sarcoma of the ciliary body. "The cyst arose in the epithelial lining of the anterior part of the ciliary body, both layers having a share in its formation, but the unpigmented being chiefly active." The cyst followed an old chorioretinitis.

In 1910, Pagenstecher [9] published a paper on multiple cysts of the posterior iris layer and the ciliary body. He stated that in 1906, Wintersteiner presented to the Heidelberg Congress a "primary cyst of the posterior surface of the iris, which was the first of its kind." In Pagenstecher's case, the diagnosis was made of sarcoma of the ciliary body, or tumor extending from the posterior surface of the iris. The eye was removed under a local anesthetic. The microscopic examination proved the mass to be a multilocular cyst. He concluded his paper with the statement, "Taking into consideration the clinical picture, showing a

6. Eales, E., and Sinclair, W. W.: Uveal Cyst of the Iris, Tr. Ophth. Soc. U. Kingdom **16**:56, 1896.

7. Schieck, F.: Ueber figmentierte Cysten an der Irishinterfläche, Klin. Monatsbl. f. Augenh. **42**:341, 1904.

8. Coats, George: An Unusual Form of Cyst of the Iris, Roy. Lond. Ophth. Hosp. Rep. **17**:143, 1908.

9. Pagenstecher, A. H.: Multiple Cysten an der Irishinterfläche und am Corpus ciliare. Arch. f. Ophth. **74**:290, 1910.

dark brown tumor coming from the posterior chamber, one will not make a mistake by calling it pseudo melano-sarcoma of the ciliary body."

In 1914, Weeks [10] reported an interesting case of bilateral occlusion of the pupils and uveal cyst, occurring in a young woman, aged 28. He spoke of the free spherical pigmented bodies that were observed in the anterior and posterior chambers.

In the same year (1914), Tertsch [11] wrote an exhaustive article on spontaneous cysts of the iris. He found reports in the literature of fifty-one cases of nontraumatic cyst. Among these, forty were really spontaneous, and seven were composed of the pigment epithelial layer.

In 1919, Rados [12] reported two cases of pigmented cyst of the iris, but they were embedded in the anterior layers.

In 1920, Fischer,[13] in reporting a case of spontaneous cyst of the posterior surface of the iris, mentioned cases of Collins, Eales and Sinclair, Wintersteiner, Pagenstecher and Ashayama. His own case made the sixth. The cyst was dark brown, mobile and opaque. It was removed according to the method of Elschnig. In drawing conclusions concerning the genesis, he said: "Since the new embryologic investigations seem to prove that the iris has only one layer of pigmented epithelium, there would be no possibility of splitting of two pigmented layers of iris."

In 1921, Vogt [14] mentioned the fact that he had observed four cysts of the pupillary pigment up to that time. They were brown, but easily transilluminated with a beam of light from the slit lamp. The upper surface was smooth and stretched. They were either single or multiple. Pigment granules were visible on the surface. They occurred on the pupillary border, or extended back on the posterior surface of the iris, and lifted it away from the anterior capsule of the lens. These cysts were accompanied by chronic glaucoma. Miotics had been used freely, but an operation had not been performed. He questioned whether the cysts were produced by the glaucoma, or by the effect of miotics which caused an increased secretion with a damming back of the flow by pupillary contraction.

---

10. Weeks, J. E.: A Case of Symmetrical Occlusion of the Pupils by the Development of Cysts and Small Solid Masses from the Uveal Layer of the Iris, Arch. Ophth. **48**:483, 1914.

11. Tertsch, Rudolph: Die spontane Iriscyste, Arch. f. Ophth. **88**:72, 1914.

12. Rados, A.: Ueber spontane Iriscysten und traumatische Scleralcysten. Arch. f. Ophth. **99**:152, 1919.

13. Fischer, M. A.: Ein neuer Fall einer spontane pigmentierten Zyste der Irishinterfläche, Klin. Monatsbl. f. Augenh. **65**:876, 1920.

14. Vogt, A.: Zistenbildung der Pupillarpigmentsaumes, Klin. Monatsbl. f. Augenh. **67**:330, 1921.

Two years later, Vogt,[15] in writing of cysts of the posterior layer of the iris, illustrated, by colored reproductions, those just mentioned, and quoted from a case reported by Lüssi in which a spontaneous uveal cyst appeared in an eye without glaucoma. He said: "It is impossible to determine from the clinical examination whether the wall of the cyst is formed by the whole retinal double layer or whether the fluid accumulated between these layers. The second is more probable. . . . An explanation of the cystogenesis is so far impossible; one can think of a secretory action of the pigmented epithelium or lymph stasis." He quoted the case seen by Fuchs in 1885 in which the pigment cyst, free in the anterior chamber, intermittently emptied and refilled itself.

In 1926, Braunstein[16] published a paper on multiple spontaneous cysts of the posterior iris layer. He said that Fischer[13] reported the first spontaneous cyst of the posterior layer of the iris which was properly placed by the clinical diagnosis. His own case was similar, but differed in being multiple. He mentioned the fact that this was the first case to be diagnosed by the new examining methods. He agreed with Fischer that these cysts are along the line of proliferation of pigment epithelium, but not through the separation of its two layers.

With the evolution of the slit lamp and more exact methods of examination, cysts of the posterior layer of the iris are not as rare as they formerly seemed to be; but the exact genesis of these cysts is still not definitely fixed. For that reason I report the following case:

REPORT OF CASE

History.—J. B., a man, aged 48, admitted to the hospital on Nov. 1, 1927, complained of loss of vision in the right eye, and great pain and failing vision in the left eye of four months' duration. The family history was negative. At the age of 12, he had pneumonia, at 19, urethritis, at 27 and 28, inflammatory rheumatism and at 31, acute tonsillitis. For twelve years, he had suffered from recurrent attacks of iritis.

Examination.—The nose, throat, sinuses, teeth, gastro-intestinal tract, blood and urine were normal. An x-ray picture of the chest revealed nontuberculous infiltration of both lungs; intradermal doses of old tuberculin of 0.01 mg. gave positive reactions. The basal metabolism was + 17. Examination of the genito-urinary tract revealed chronic prostatitis.

Eyes: Both eyes showed total posterior synechiae, with iris bombé. In the left eye, there was at the pupillary margin (at 11 o'clock), a dark brown mass, 3 by 3.5 mm., protruding from the posterior pupillary margin. With the slit lamp, the cornea appeared to be clear and the anterior chamber shallow; a marked increase was not observed in the visibility of the aqueous ray. The cyst was dark brown, nontranslucent, granular and restricted at its base. Under high

15. Vogt, A.: Pupillarpigmentsaumcysten und Cysten des marginalen Irishinterblattes, Arch. f. Ophth. **111**:95, 1923.

16. Braunstein, E.: Multiple spontane pigmentierte Cysten der Irishinterfläche, Arch. f. Ophth. **115**:381, 1925.

magnification, its surface was seen to be stippled with pigment granules (fig. 1). The iris was atrophic; pigment granules were present on its anterior surface and on the anterior capsule. Originally, the eyes were brown.

Examination with the ophthalmoscope showed the media hazy, the fundus blurred and large patches of retinitis proliferans in the right eye, and the media hazy, the vessels engorged and tortuous, the disk cupped, and the color good in the left eye. Vision in the right eye was 20/200 (eccentric); in the left eye, 20/40. The tension (Schiotz) was: right eye, 13; left eye, 43.

On Nov. 10, 1927, transfixion of the iris was performed on the left eye. For some time, the tension remained about 15 mm., but later it rose to 43.

On Dec. 1, 1927, the sclerocornea was trephined with peripheral iridectomy. Two weeks later, the tension was 13 mm. With the reduced tension, the cyst in the left eye collapsed; its rather thick folded anterior wall is shown in figure 2.

Since the drawings were made, the opaque lens has been removed. The intra-ocular tension remains below 18 (Schiotz), and the patient's vision is 20/50 and is improving. It was not possible to make a microscopic examination of the collapsed cyst.

Fuchs[17] said: "As a rule synechiae ensue from the attachment of the posterior surface of the iris to the anterior surface of the lens." . . . The pigment epithelium separates easily from the dilator by the pulling from posterior synechiae." In this patient, the cyst seemed to have been caused by the pressure of the aqueous, which stretched the entire uveal layer, but, in addition, there was proliferation of the pigment epithelial cells with a deposit of migrating pigment granules on the cyst wall. It is certain that the walls of the cyst were much thicker than the stretched uveal layer of the iris could be.

Recently, I examined a patient with quiescent uveitis in both eyes. In the right eye, there was marked punctate keratitis, with pigment granules on the lower part of the cornea, and organized exudate on the anterior surface of the lens, but no synechiae. At the pupillary margin, were seen some twenty or more minute, pedunculated cysts, some of which had become confluent. The largest cyst was not over 1 mm. in diameter, and all of them were thin walled, translucent and speckled over with pigment granules. The vision and fields of the left eye were normal; but in the right eye there was a marked paracentral scotoma, due to extensive chorioiditis. The vision was 3/200. The intra-ocular tension was normal in each eye.

To gain access to all the reports of cases of cyst of the uveal layer of the iris was, of course, impossible, but I found the records of thirty-six cases. Twenty of them were primary; seven were caused by injury; three were consequent on glaucoma after injury, and six followed occlusion of the pupil or glaucoma. My case belongs in the last division and adds one more to the number.

---

17. Fuchs, Ernst: Lehrbuch der Augenheilkunde, Leipzig, Franz Deuticke, 1926, pp. 453 and 432.

Cysts of the iris have been classified morphologically by a number of authors (Hulke,[1] Collins,[5] Weeks,[10] Tertsch [11] and others). They have been classified also in accordance with their anatomic position: cysts of the anterior layers of the iris; cysts free in the anterior chamber, and cysts of the pigment epithelial layer. Cysts of the pigment epithelial layer can be still further divided into those that are primary and those that follow synechiae with glaucoma.

It is interesting to note that in six instances (recorded by Schieck,[6] Wintersteiner,[18] Coats,[8] Pagenstecher,[9] Stephenson [19] and Roth and Geiger [20]) the affected eye was removed because of the impression that the solid looking tumor mass was a melanosarcoma. Four were primary cysts.

Spontaneous cysts are particularly interesting not only from the standpoint of their pathogenesis, but also from the fact that, although they are true cysts, in some instances their walls are so nontranslucent and so solid looking that even with the modern aids to diagnosis, the most experienced observer is compelled to consider the possibility of their being malignant.

Melanosarcomas are found in a position similar to that of the spontaneous cysts. In some cases of primary cysts of the pigmented layer of the iris, their true nature can be ascertained only by the removal of a piece of the iris with the cyst.

When the eye is painless, and there is useful vision, this, or some similar procedure, should be resorted to before enucleation.

---

18. Wintersteiner: Ueber primare (idiopatische) pigmentierte Cysten der Irishinterfläche, Ber. u. Heidelberger Ges. **33**:345, 1906.

19. Stephenson, Sydney: A Cyst of the Pigment Epithelium of the Iris, Tr. Ophth. Soc. U. Kingdom **36**:270, 1916.

20. Roth, J. H., and Geiger, C. W.: Posterior Chamber Cysts of the Iris, Am. J. Ophth. **8**:870, 1926.

MENINGIOMAS ARISING FROM THE TUBERCULUM SELLAE

WITH THE SYNDROME OF PRIMARY OPTIC ATROPHY AND BITEMPORAL FIELD DEFECTS COMBINED WITH A NORMAL SELLA TURCICA IN A MIDDLE-AGED PERSON

HARVEY CUSHING, M.D.
AND
LOUISE EISENHARDT, M.D.
BOSTON

(Concluded from page 41)

An equally large tumor, to judge by the weight of the fragments that were preserved, was successfully removed three months later from the next case. This tumor also had failed to give neighborhood symptoms beyond those of the syndrome under discussion, though the adiposity and scanty menstruation suggested a nearly hypophysial involvement.

CASE 12.—*Failing vision for eighteen months advancing to near blindness. Primary optic atrophy. Bitemporal hemianopsia advancing to unilateral blindness. Normal sella. Correct preoperative diagnosis. Operation. Total piecemeal removal of a 16 Gm. tumor. Recovery with marked improvement in vision in the left eye, stationary after two years.*

July 8, 1926: Admission of Mrs. Rose B., 37 years of age, with the sole complaint of loss of vision; referred by Dr. George de Schweinitz through Dr. Otto Lowy of Newark, N. J.

History.—Until *December, 1924,* the patient had never consulted a doctor. At about that time she first observed dimness of vision first in the left eye and soon in the right. In the course of two months, sight became so greatly impaired that reading vision was lost. There were occasional mild headaches, and she was subjectively aware of the bitemporal nature of the blindness.

In *October, 1925,* she consulted Dr. de Schweinitz, whose report records an atrophic pallor, more evident in the right eye with markedly constricted fields which showed a complete bitemporal blindness with vision reduced to counting fingers at 50 cm. Though the visual fields were taken to indicate a lesion of the chiasm, the possibility of some toxic process was favored in view of the sudden onset of the trouble. As the spinal fluid showed a suggestively positive Wassermann reaction, she was given a prolonged and vigorous course of antisyphilitic treatment which failed to influence her condition. She had always been inclined to moderate obesity. Menstruation for three or four years had been scanty and irregular. No polyuria or polydipsia was observed.

Examination.—Objectively she showed nothing more than a slight adiposity with extreme primary atrophy and bitemporal hemianopsia which had advanced (fig. 46) so that mere perception of light was retained in the right nasal field and only an upper nasal quadrant of vision remained in the left eye, where the acuity was estimated at 20/200ths. The olfactory sense was unimpaired. The sella (fig. 47) was within normal limits. The basal metabolic rate was −6 per cent. There was no polyuria.

The *diagnosis* of suprasellar meningioma was made and an exploration advocated. The patient requested a month's delay and re-entered the hospital six weeks later for the operation.

Operation.—Aug. 25, 1926: Under ether anesthesia, in the course of the customary transfrontal operation, the anterior margin of the expected tumor was disclosed. The right optic nerve was greatly flattened; the left was never clearly identified. The central portion of the tumor was excavated in the usual piecemeal fashion (fig. 48) until freed from its attachment on the tuberculum; and finally the posterior portion of the growth was tilted out in one large intact piece without bleeding (fig. 49). This left a clean suprasellar excavation, in the posterior portion of which one could see that the intact wall of the flattened third ventricle was beginning to fill out with fluid. Usual detailed closure without drainage.

The Tumor.—The fragments removed weighed 16 Gm. The tissue histologically showed a typical meningioma without psammomatous change.

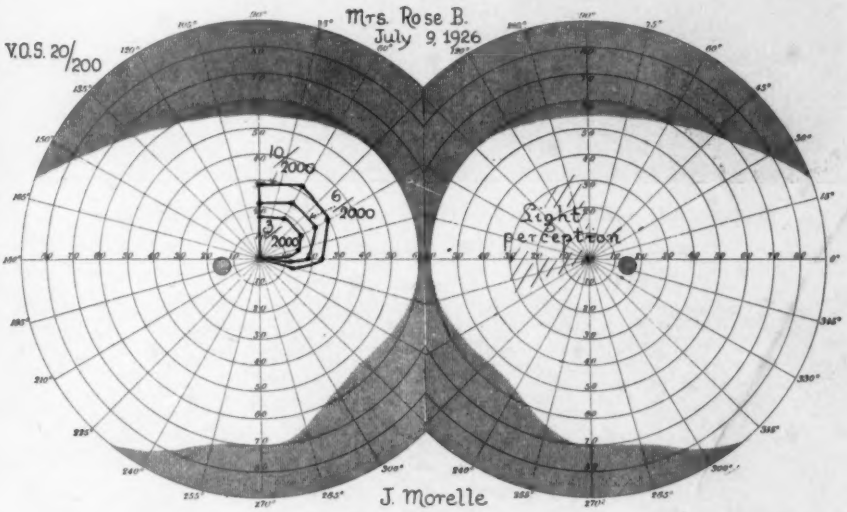


Fig. 46 (case 12).—Fields on patient's admission (screen method with 10, 6 and 3 mm. disks).

Postoperative Notes.—There was some postoperative headache, but convalescence otherwise was smooth with perfect healing (fig. 50). She was finally discharged on *Sept. 15, 1926,* with no apparent change, subjective or objective, in her visual acuity except that the faint light perception on the right had been lost. The field peripheries, however, on the left (fig. 51) showed signs of widening.

Subsequent Notes.—About a month after her discharge, Dr. Lowy reported a distinct improvement in vision with return of sight in the upper left temporal field. On *March 14, 1927,* fields taken by Dr. Rados of Newark showed that the temporal blindness in the left eye had totally disappeared.

On *July 27, 1928,* nearly two years after the operation, the patient reported for an examination. She had gained from her preoperative weight of 190 pounds (86.2 Kg.) to 215 pounds (97.5 Kg.). Though the right disk was paper-white and the retina without light perception, a marked improvement had taken place in the left eye where, in contrast to the preoperative acuity of 20/200 it was now 20/40,

Fig. 47 (case 12).—Showing sella of approximately normal configuration.

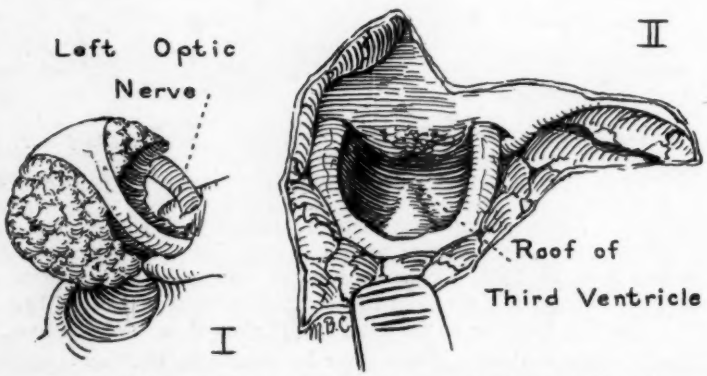


Fig. 48 (case 12).—From surgeon's sketches made at conclusion of operation, showing: *I*, obliquely the assumed relation of the partly excavated tumor to the encircling nerves and chiasm; *II*, the appearance after the tumor extirpation, showing the bulge made by the filling third ventricle.

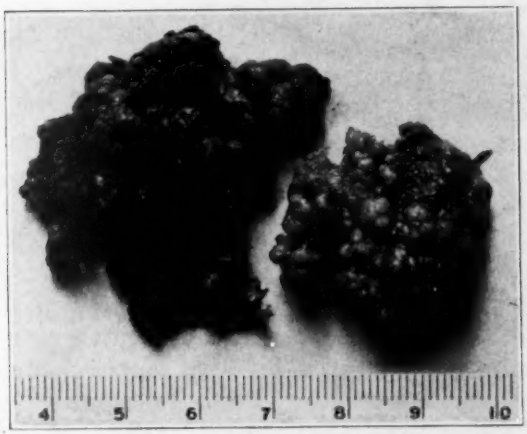


Fig. 49 (case 12).—Showing fragments of tumor, the single large piece to the right with the nodular surface being the last to be removed.

Fig. 50 (case 12).—Patient on fourteenth day after operation, showing inconspicuous wound.

UNIV. OF MICH.

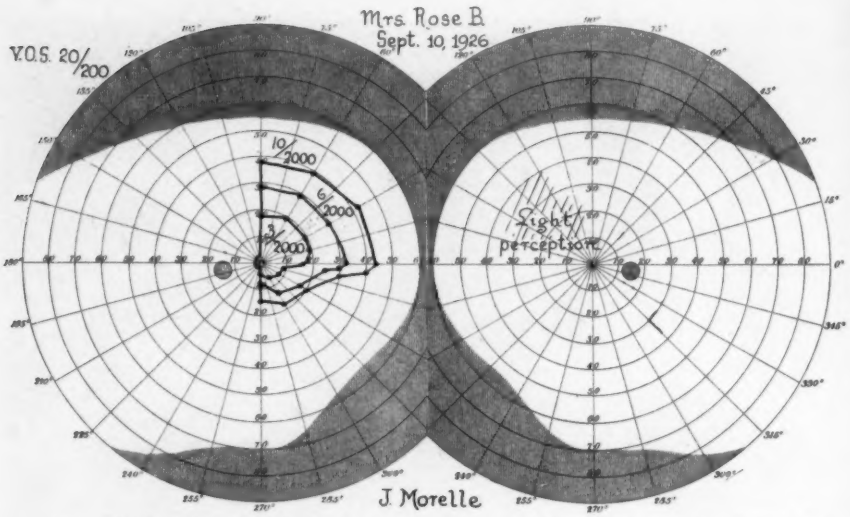


Fig. 51 (case 12).—Fields before patient's discharge, for comparison with figure 46, showing presence of improvement.

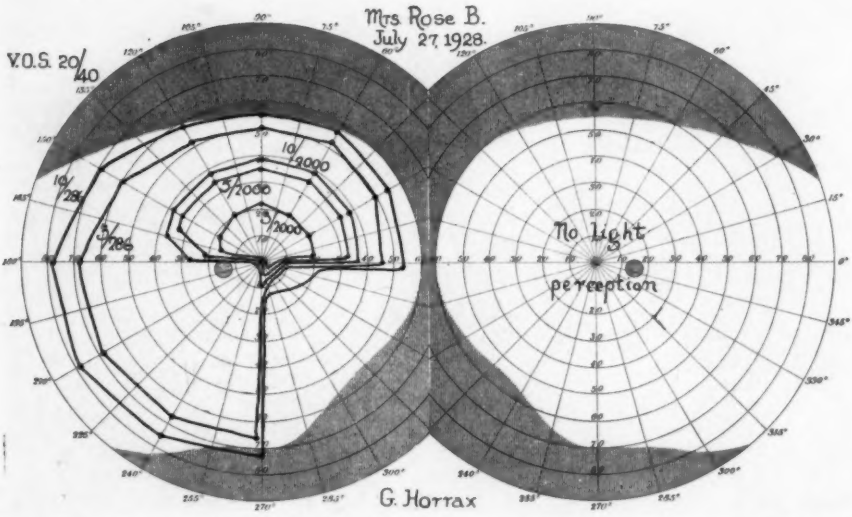


Fig. 52 (case 12).—Patient's fields of vision two years after operation, for comparison with figure 46 (combined perimetric and screen methods with 10, 5 and 3 mm. test objects). To the screen there was a lower horizontal hemianopsia (cf. fig. 65).

with reading vision for large print. The fields (fig. 52) had opened up above the horizontal to such an extent that with a 10 mm. disk on the screen the temporal seeing area was almost equal to the preoperative nasal field. To the perimeter only the lower nasal quadrant remained defective.

Comment.—Though the tumor in this case was a large one (16 Gm.) and the process had gone on almost to total blindness, there was as yet no evidence of any secondary pituitary symptoms unless the adiposity and the irregular menstruation may be so considered. Though the tip of the third ventricle and infundibulum were fully exposed by the tumor extirpation, there fortunately was no subsequent polyuria. Evidently in this case the right optic nerve had been damaged beyond repair by the prolonged compression; and so little improvement had taken place in the left eye when the patient was discharged after the operation that it was feared that the nerve had suffered from operative contusion. The case, like the preceding one, shows, however, that there may be a slow and gradual return of function, and the ultimate result in the two cases has been almost equally good.

* * * * * *

With the exception of case 1, in which, from inexperience, the nerves were damaged, and case 5, which was lost through a surgical accident, the following case came to operation in a stage more favorable for a good operative result than any other in the series.

CASE 13.—*Fluctuating failure of vision for twenty-six months. Primary optic atrophy and bitemporal hemianopsia with a normal sella. Correct preoperative diagnosis. Operation. Extirpation of tumor. Recovery with prompt improvement in vision.*

Aug. 19, 1926: Admission of Mrs. Helen J., aged 42, referred by Dr. Sidney A. Portis of Chicago with the sole complaint of failing vision.

History.—The patient had had uniformly good health all of her life, except for a tendency to headaches and susceptibility to tonsillitis. In *June, 1924,* she first noticed some light obscuration of vision, but it was not until *March, 1925,* that she was sufficiently troubled to consult an oculist, who prescribed glasses. From this time the failure was more rapid, and by the end of April the vision on the right had become greatly impaired. Under the supposition that she was suffering from the effects of some toxic process, a lumbar puncture was made, and finally a gallbladder operation was advised. This was refused, and she was put on a diet. In *February* and *March, 1926,* she took a "cure" at Hot Springs. Subjectively a bitemporal loss of vision was appreciated.

Examination.—This showed a well nourished woman with wholly negative physical and neurologic findings apart from the eyes. The optic disks had a marked pallor of atrophy. There was a typical and fairly symmetrical bitemporal hemianopsia (fig. 53), though vision was more affected on the left. The acuity being only 10/100 compared to 10/70 on the right, where there was greater constriction. The olfactory sense was unimpaired. The sella was essentially normal in size, shape and position (fig. 54). There were no secondary hypophysial symptoms. The basal metabolic rate was −3 per cent.

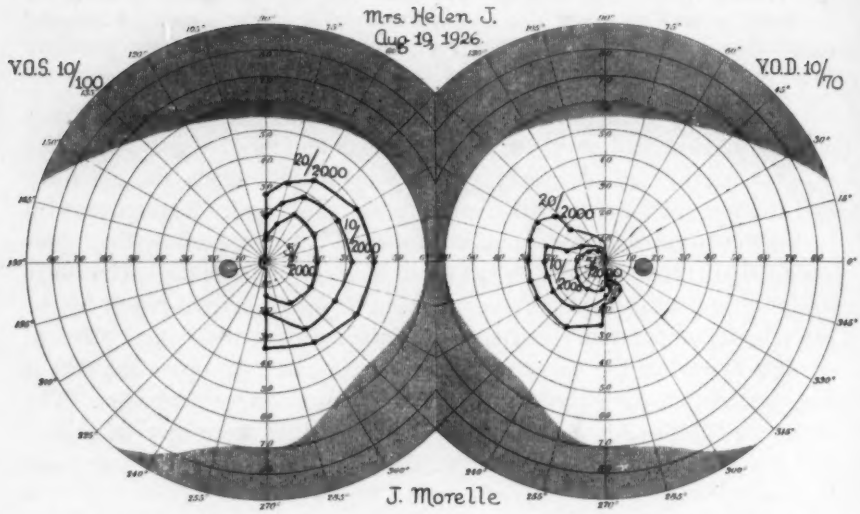


Fig. 53 (case 13).—Patient's fields of vision on admission (screen method with 20, 10 and 5 mm. disks).

Fig. 54 (case 13).—Showing sella of normal configuration with heavy posterior clinoid processes.

The *diagnosis* of a probable suprasellar meningioma was made.

Operation.—Aug. 30, 1928: Under local anesthesia, great difficulties again were encountered in turning back the usual frontal flap, because of a densely adherent and friable dura which necessitated the use of the Doyen saw; and the patient finally had to be given ether before the flap could be elevated. The remainder of the operation was without untoward incident. The tumor was readily exposed, and its anterior portion was excavated in the usual fashion until its attachment to the tuberculum was freed. Finally, the loosened posterior shell of the growth was lifted out in its entirety—an unusually large fragment. The fossa appeared to be entirely free from any remaining tags of the growth. One or two oozing spots were covered by small muscle stamps, and the flap was replaced without drainage.

The *tumor fragments* (fig. 55) weighed all told 13 Gm. Sections showed a typical meningioma.

Postoperative Course.—Convalescence was uneventful. Healing was perfect (fig. 56). By the third day, she was conscious of distinct improvement in her

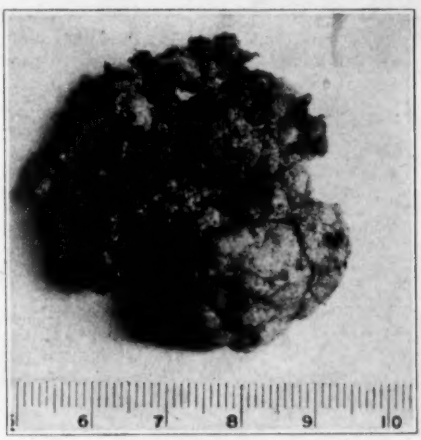


Fig. 55 (case 13).—The fragment of the 16 Gm. meningioma, the large intact piece last removed shown below and to the right.

sight with perception of objects in both of the previously blind temporal fields. Improvement was continuous, and at the time of her discharge, on *Sept. 15, 1926,* the fields (fig. 57) were well expanded except for a lower nasal constriction in the left eye.

Subsequent Notes.—The patient has frequently written of her constantly improving vision. On *March 1, 1927,* Dr. Frank Brawley sent some perimetric charts, which show normal peripheries on the right with an acuity of 6/15. On the left, where vision had become, with correction, practically normal (6/6 + cor.), the lower nasal field still showed traces of the defect present in the charts at the time of her discharge (cf. fig. 57). On *Nov. 1, 1927,* still further improvement in acuity was announced.

The patient reported in person for an examination on *July 17, 1928,* nearly two years after the operation. She had been in normal health and was scarcely conscious of the trifling residual field defects (fig. 58) which were suspiciously homonymous in character though the defect in the right eye might be otherwise

Fig. 56 (case 13).—Showing the condition of the wound on the seventeenth postoperative day.

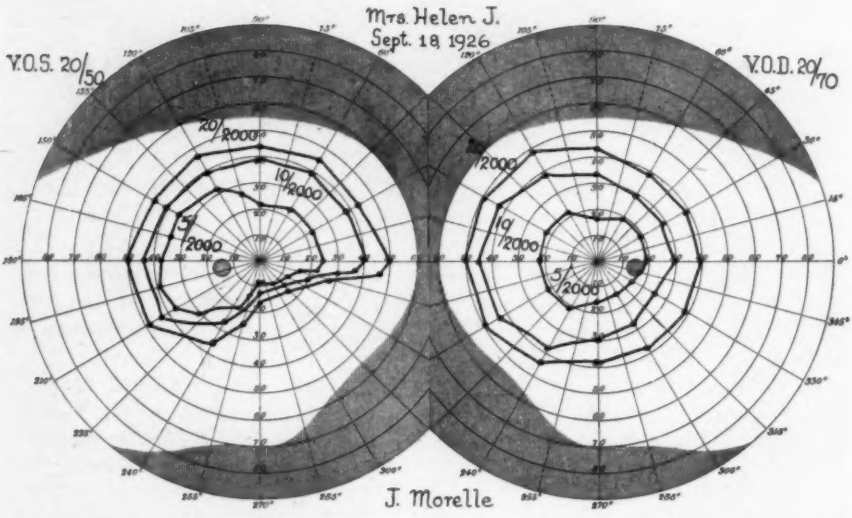


Fig. 57 (case 13).—Visual fields sixteen days after operation for comparison with figure 53 (screen method).

explained. The disks, though grayish, were of fairly good color. Curiously enough, there was no demonstrable impairment of the olfactory sense on the right side.

Comment.—Mention was made in the preceding case or two of the great difficulty that may be encountered in the elevation of the frontal boneflap in some of these patients because of the thin, friable and densely adherent character of the dura. As already stated (January issue, p. 17), on one occasion the operation was actually abandoned because of these difficulties. By this time, however, confidence in our ability to deal with the situation had become somewhat restored, and we had begun to feel greater assurance in regard to the preoperative diagnosis of the condition. We accordingly ventured to suggest to this patient that she should

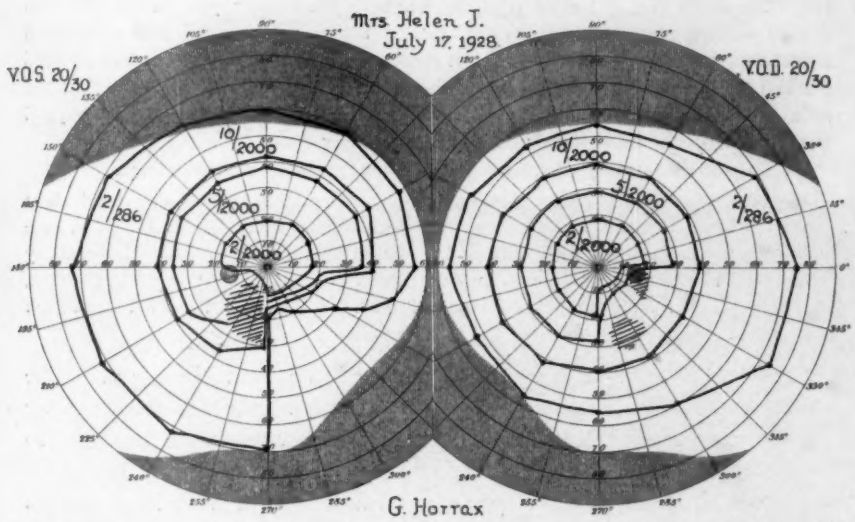


Fig. 58 (case 13).—Fields of vision two years after operation (combined screen and perimetric methods), for comparison with figures 53 and 57.

return for another attempt. The case, therefore, is out of chronological order so far as the hospital admission is concerned, but in the proper sequence so far as concerns the date of tumor verification.

CASE 14.—*Failing vision for twenty months. Primary atrophy with bitemporal field defects and normal sella. Previous ethmoidal operation. Correct preoperative diagnosis. Transfrontal operation abandoned owing to risk of elevating flap. Further loss of vision. Second operation three years later, with successful removal of tumor aided by electrosurgery. Temporary polyuria. Subsequent marked improvement in vision.*

Jan. 15, 1924: Admission of Miss Hattie L., a hairdresser, 40 years of age, complaining of failing vision; referred by Dr. Mark Schoenberg of New York.

History.—The patient after a life of uniformly excellent health began in *March, 1922,* to have some intra-ocular discomfort and to notice impairment of

vision in the left eye. Glasses were prescribed. The vision grew progressively worse in spite of all that various consultants could suggest, until in the course of the next year and a half the left eye became nearly blind. She was then advised to have an operation on her sinuses, and on *Nov. 21, 1923,* after a submucous resection of the septum, "the left ethmoid cells were completely exenterated" and the sphenoid cells opened. She was said to have received temporary relief. Then nine teeth were extracted also with supposed temporary improvement in vision. After these episodes, she came under Dr. Schoenberg's care.

Examination.—The patient was a well nourished Jewess, with no complaints other than loss of vision. The physical, as well as the neurologic clinical findings were wholly negative, apart from the eyes, except for slight deafness in the left ear due to an otitis media sustained in childhood, and a lowered olfactory sense on the left side due presumably to the recent operations on the nose.

There was a bilateral optic atrophy with pallor less marked on the right than left. The fields (fig. 59) showed a complete temporal hemianopsia on the left with 20/200 acuity, whereas on the right, merely an upper temporal and quadrantal defect was demonstrable to a 1 mm. test object. The x-ray film of the skull showed marked thickening and irregularity of the inner table of the frontal bone, but the sella was essentially normal (fig. 60). There were no constitutional hypophysial manifestations, the basal metabolic rate was $\pm$ 0 per cent.

A *diagnosis* was made of a suprasellar lesion, probably a meningioma.

Operation.—Jan. 25, 1924: Under ether an attempt to outline the usual right frontal boneflap was abandoned, owing to the extreme difficulties of the procedure caused by the thick and irregular bone to which a thin dura was almost inseparably adherent. The wound, which was closed without our venturing to elevate the flap, healed perfectly, and she was discharged on *Feb. 3, 1924,* with her condition unchanged.

Interval Notes.—During the course of the next three years, the patient reported by letter every six months or so. She was an optimistic woman, who continued as best she could with her work and managed to keep away from ill-advised therapeusis, though in *August of 1926,* she submitted to a series of deep x-ray treatments which at least did no harm. Meanwhile her vision was progressively declining.

Under the encouragement of the results obtained in the four preceding cases, it was suggested to her in the spring of 1927 that she return for a further attempt, since we had learned enough in the three years' interval to be more certain of the diagnosis and were reasonably sure that the tumor might be removed if we could only expose it.

Second Admission.—April 17, 1927: Subjectively she had been experiencing some headaches of a mild sort for the preceding few months. They were brought on by any form of excitement or nervous strain. She, however, had continued with her occupation, although the vision in the left eye had long been practically nil, and she had become conscious of a temporal blindness on the right. She had been dieting, and had succeeded in reducing her weight from 156 to 144 pounds (70.8 to 65.3 Kg.). Her catamenia had shown no noteworthy irregularity.

Examination.—The optic atrophy was far more pronounced than on the previous admission, particularly in the right eye, where there was previously only a moderate pallor. The left eye was to all purposes blind, though a faint pupillary reaction to

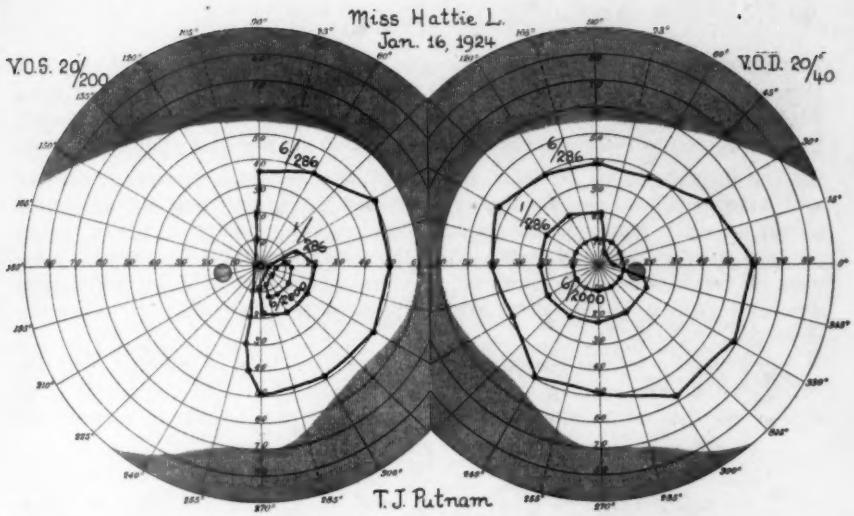


Fig. 59 (case 14).—Patient's fields of vision on her first admission in 1924 (screen and perimeter).

Fig. 60 (case 14).—Cranial roentgenogram on patient's first admission, showing endostoses of frontal bone and practically normal sella.

UNIV. OF MICH.

bright light was retained. The consensual reaction was normal. The right eye showed a temporal hemianopsia (fig. 61) with vertical meridian, the acuity being 20/40 corrected. The sellar outlines compared with the plates taken three years previously showed definite beginning absorption of the posterior clinoid processes.

Operation II.—April 24, 1927: Under local anesthesia, the flap was re-outlined with extreme difficulty. The bone was thick and eburnated and when elevated almost the entire dura over the frontal lobe came away with it, fortunately without serious injury; and though two or three anchoring veins were torn, these were easily picked up and coagulated. Fortunately the dura over the orbital plate was less adherent and could be used to protect the lobe during its subsequent elevation.

The remainder of the operation was conducted in the usual fashion, with the exception that the primary excavation of the central part of the tumor lying between the separated optic nerves was made with the desiccating current and

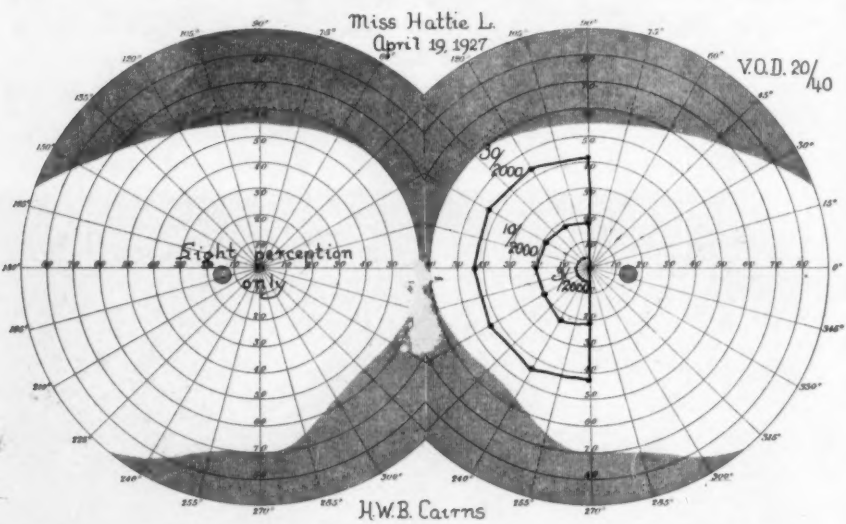


Fig. 61 (case 14).—Fields of vision on patient's second admission, showing, for comparison with figure 59, the progress of the defects in a three-year interval (screen method with 30, 10 and 3 mm. disks).

Bovie's loop and consequently was quite bloodless (fig. 62). By this method, moreover, the tumor was cleanly and bloodlessly separated from its usually somewhat vascular attachment to the tuberculum sellae.

With this step accomplished, it was an easy matter to tilt out the posterior half of the tumor quite intact with less chance of injury to the optic nerves than in any of the preceding cases. The cavity from which the tumor was dislodged was left quite clean, and as a final step the roughened dura over the tuberculum was brushed with the dehydrating current to kill such tumor cells as might possibly remain within the dural clefts. After the shreds of torn dura over the anterior surface of the frontal lobe were replaced so far as possible, the flap was put back and the wound closed.

The Tumor.—Such fragments as had been preserved (fig. 63) weighed 11.5 Gm. Histologically, the growth was a nonpsammomatous meningioma.

Postoperative Notes.—Convalescence was less smooth than usual owing to some headache, drowsiness and a slight temporary polyuria and polydipsia. This amounted to 7 liters on the first day and to 5 on the second; then, after a remission of a week, there was another period of five days with a 4 liter intake, which then subsided. Healing, however, was perfect (fig. 64), and after the tenth day her disturbing symptoms subsided. The visual acuity improved in the right eye to 20/30 by the time of her discharge on *May 21, 1927,* and though the test objects were seen over a wider area, the temporal hemianopsia persisted. The left eye remained blind.

Subsequent Notes.—She resumed her occupation shortly after her return home. Dr. Schoenberg wrote a year later to say that in the interval the condition has remained essentially unchanged, though in favorable light she has regained percep-

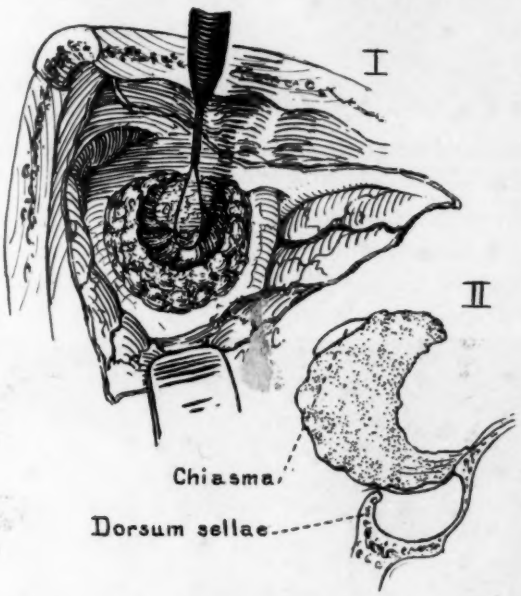


Fig. 62 (case 14).—Taken from surgeon's immediate postoperative sketches to indicate the first stage of the operative procedure.

tion of movement in the nasal field of the left eye. On the right, the temporal hemianopsia remains complete, but the acuity has improved to 20/30+. "With proper correction, she is able to read Birkhauser 0.8, whereas before the operation 0.6 was the best she could do."

The patient reported in person on *July 5, 1928.* She was active and in excellent condition. There had been no further polyuria. The fields remained as of the date of *April 19, 1927* (cf. fig. 61). She had put on some extra flesh and weighed 160 pounds; her menses had begun to be irregular—probably a normal menopause in view of her age.

Comment.—This case, then, to recapitulate, was that of a woman with the typical syndrome under discussion which at the time of her first admission, in January, 1924, was not sufficiently well under-

Fig. 63 (case 14).—Photograph of such fragments of tumor as were collected at operation; weight 11.5 Gm. The large posterior fragment to the left.

Fig. 64 (case 14).—*A*, photograph of patient on eighteenth day, showing inconspicuous wound in spite of secondary operation; *B*, photograph taken a year later to exaggerate, as far as possible, by shadows the site of operation.

stood to justify more than a presumptive diagnosis of suprasellar meningioma. She had already been subjected to an ethmoidal operation, which a few years ago was commonly advocated by rhinologists for optic atrophy of obscure etiology. A transfrontal exploration with the purpose of exposing the chiasm was abandoned owing to difficulties in reflecting the boneflap, as it was thought the risk of life from completing the operation outweighed the uncertainty of accomplishing much were the anticipated lesion exposed. During the next few years, the syndrome became better understood; some encouraging cases had been encountered; and she accordingly was sent for. Owing to the newly acquired assurance that something might be done to save vision if the difficulties of the approach could be overcome, she was advised to undergo another trial, partly under the encouragement from the safeguards afforded by electrosurgical methods with which we were at the time beginning to be familiar.

* * * * * *

The preceding series of six wholly successful operations conducted without any serious accident in dealing with the lesion when it had once been exposed was broken by the following and last of the cases in which an accident, like that in case 2, was due to bleeding from an injured artery, though on this occasion the vessel was fortunately caught before there were serious consequences. The episode, however, led to the abandonment of the operation before the enucleation was completed. Though we may have to pay for the fragmentary removal of the lesion by an early recurrence of symptoms, the patient has temporarily shown marked improvement. The case is another example of the confusion that may be caused by apparent improvement in vision after sinus operations when they are used as a diagnostic test in obscure cases of supposed toxic neuritis with atrophy.

CASE 15.—*Failing vision for fifteen months, more marked on left. Primary optic atrophy. Drainage of sphenoidal sinus. Further progress of symptoms with atypical bitemporal hemianopsia. Operation with incomplete removal of typical suprasellar meningioma. Recovery with restoration of normal vision in right eye.*

Aug. 10, 1927: Admission of Miss Jessie W., a trained nurse, 27 years of age, complaining of failing vision; referred by Dr. George Derby of Boston with the presumptive diagnosis of pituitary disease.

History.—The patient's only noteworthy illness had been an attack of catarrhal jaundice at the age of 15. In 1923, long before the onset of her visual trouble, both maxillary sinuses had been opened and drained because of a chronic infection. She became aware in *April, 1926,* of obscuration of sight in the left eye, and a perimetric examination at the time disclosed some constriction of the fields, more particularly on the left. X-ray films were immediately taken, and were said to show a sphenoiditis, for which an operation was performed and irrigation of the sinus advocated. Perimetric tests were said to show subsequent improvement in

the fields of vision, but the patient appreciated no subjective change for the better, and the prescribed treatments were neglected. By *February, 1927,* vision in the left eye had failed markedly, and by June the right eye had begun to show subjective impairment. Consequently in *July, 1927,* a second exploration of the left sphenoidal cells was made, but no pus was found. Cranial x-ray films were interpreted as excluding pituitary disease, and a neurologic examination as excluding multiple neuritis.

Apart from the failure of vision, she had been free from symptoms except for some left-sided frontal headache, which she ascribed to her sphenoidal operations, and an occasional feeling of discomfort in the left eyeball. She finally consulted Dr. Derby, who referred her to the Brigham Hospital.

Examination.—This disclosed in an otherwise normal person a primary optic atrophy on the left and marked temporal pallor on the right. The fields (unfortunately taken on the screen only) were peculiar in showing (fig. 65) an enlarged blind spot on the right with a surrounding temporal scotoma, whereas on the left there was a residual upper field of vision for large objects separated horizontally from the wholly blind areas below. Vision in the left eye was 20/200 with scant ability to count fingers; in the right 20/30ths. Consensual pupillary reaction was present from right to left, but lost from left to right.

The sella (fig. 66) was normal, but there appeared to be some bony thickening in the region of the left anterior clinoid process; and projecting into the cranial cavity was what appeared to be an accessory ethmoid cell that might possibly have involved the nerve. The olfactory sense was unimpaired. There were no secondary hypophysial symptoms: the basal metabolic rate was −5 per cent.

Diagnosis.—Dr. Derby was under the impression that there was sufficient haziness of the nasal margin of the right disk to justify the diagnosis of a secondary atrophy. The patient's age was against a meningioma, and we were wholly misled by the anomalous ethmoid cell into suspecting it might have some bearing on the process. The localization of the process was easy, but no definite pathologic diagnosis was ventured.

Operation.—Aug. 17, 1927: Under local anesthesia, the usual right frontal osteoplastic flap was reflected, and in the course of the subsequent steps of the procedure the anterior margin of the usual-appearing suprasellar meningioma was exposed. The tumor was somewhat more vascular than usual, and in the process of excavating it, recourse was had to the electrosurgical loop. After the right optic nerve had been fully freed from pressure, the left nerve still remained concealed, and in the attempt to get a proper view of it before tilting out the posterior shell of the tumor, a vessel (presumably the anterior cerebral) was injured, and for a moment there was sharp bleeding. Finally, by permitting the bleeding point to spurt directly into the sucker, it was possible to secure the vessel by the placement of a number of clips. As it was feared that some damage might have been done to the third ventricle in the process of checking the bleeding, it was thought wise to withdraw without attempting to remove the remaining portion of the growth still concealing and possibly enveloping the left optic nerve (fig. 67).

Pathologic Note.—The fragments of the tumor proved histologically to represent a nonpsammomatous meningioma of the usual type.

Postoperative Notes.—Except for some prolonged nausea, the patient did unexpectedly well, and though the formation of a clot was apprehended, there were no signs of it. By the third day, she was aware of marked improvement in vision on the right, where objects no longer appeared blurred. Healing was perfect (fig. 68). The fields were first taken on the fifth day and showed markedly

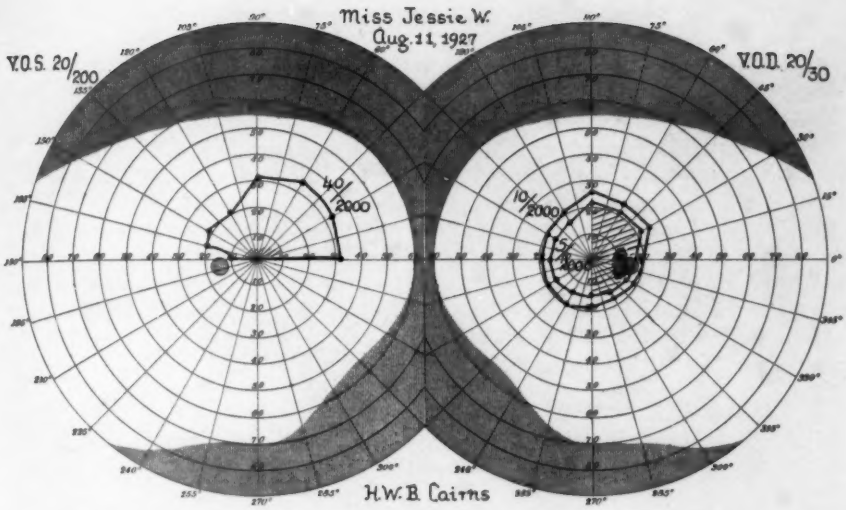


Fig. 65 (case 15).—Fields (screen method only) on patient's admission, showing the same horizontal type of hemianopsia which was apparent in figure 52 on the tests by the screen method.

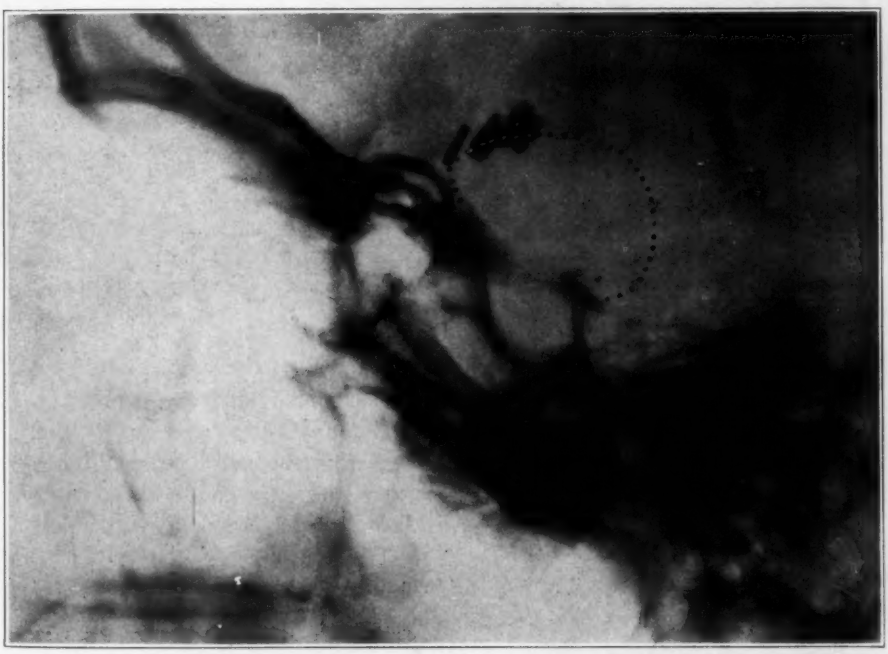


Fig. 66 (case 15).—Postoperative cranial x-ray picture, showing the normal configuration of the pituitary fossa, the thickened anterior clinoid and the bulging anomalous posterior ethmoidal cell on which a silver clip appears to be lying. The position of the other six clips used in the effort to secure the injured anterior cerebral artery serves to show where lay the upper margin of the tumor whose approximate profile is indicated by the dotted line.

widened peripheries in the right eye with 20/20 vision, which had improved (fig. 69) to 20/15 on *September 1st,* at the time of her discharge. An enlarged blind spot remained the only relic of trouble in the eye, the pallor of the nerve having largely disappeared.

Subsequent Notes.—The patient reported for observation a month later, at which time the right eye continued to be normal with full field peripheries, the enlarged blind spot persisting. There was total right anosmia, due unquestionably to injury of the right olfactory nerve at the time of the operation. She last reported on *June 7, 1928,* and at that time, ten months after the operation, the fields on the right were approximately normal, and the acuity was 20/15. On the left, the same horizontal hemianopsia present before the operation persisted, and the acuity had fallen off considerably.

Comment.—There were sufficent deviations from the typical syndrome in this case to raise some doubts as to the diagnosis. The fields of vision belied the history of bitemporal defects, and Dr. Derby was under

Fig. 67 (case 15).—Drawn from operator's sketch of the conditions at the conclusion of the operation, with the left half of the partly excavated tumor in place.

the impression that there was sufficient haziness of the nasal margin of the right disk to justify the diagnosis of a secondary rather than a primary atrophy. Though the sella was of normal configuration and though the olfactory sense was unimpaired, the x-ray film showed a peculiar bony elevation posterior to the olfactory groove and adjacent to the clinoid process. Moreover, the patient was below the average age at which meningiomas occur.

However, so far as could be told at the operation, which was necessarily terminated before its completion, the conditions were precisely those of the usual tumor of the tuberculum. The case is important from the standpoint of the syndrome in question on the very grounds of the incompleteness of the operation. In none of the preceding cases had there been a setback in symptoms after months or years, which is surprising in view of the known tendency even of radically extirpated men-

Fig. 68 (case 15).—*A*, showing on the fourteenth day the well healed and inconspicuous incision accidentally accentuated by shadow; *B*, ten months after operation.

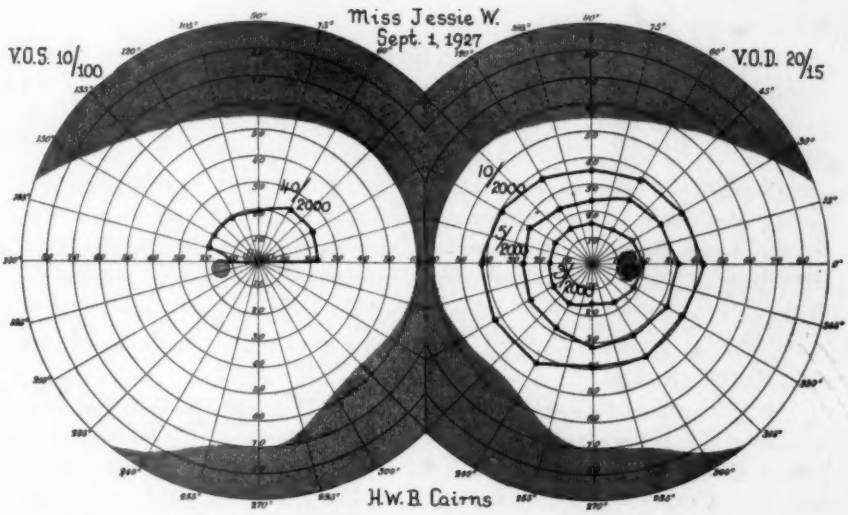


Fig. 69 (case 15).—Fields of vision at the time of discharge, for comparison with figure 65 (screen method).

ingiomas to recur when their dural attachment has not been excised together with the obvious tumor. In this young woman's case, the right nerve alone was cleared, no attempt having been made to remove completely the remainder of the tumor on the left side. We may therefore expect an early return of symptoms, and though she has done exceedingly well for ten months, this is too short a time to justify an optimistic prognosis. She has been warned that on the first evidence of any recession from the present normal acuity and field peripheries in the right eye, a secondary operation should be promptly undertaken.

* * * * * *

THE LIFE-HISTORY OF THE TUMOR

The meningiomas arising from the tuberculum sellae share with other meningiomas that occur in this region of the cranial base the peculiarity of being rather tough and fibrous in character and of having a more or less granular mulberry-like surface. They are slow-growing, have a comparatively feeble blood supply, tend to become psammomatous (five out of the fifteen cases) and often possess more collagenic fibers (four out of the fifteen cases) than do the more rapidly growing, smooth-surfaced meningiomas arising from the vault.

From case to case the tumors behave very much alike, and on the basis of their age and size may be classified (1) as presymptomatic, (2) as surgically favorable (with which stage we are primarily concerned), and (3) as advanced or surgically unfavorable. These stages are schematically represented in figure 70.

A tumor represented in stage 2, before vision was likely to have been impaired, was an incidental postmortem finding in the body of a patient who died a few hours after admission to the hospital on April 21, 1926, moribund from the effects of a perforated gastric ulcer. Fortunately for our present purposes, a complete examination was made, and on removing the brain the small tumor shown in figure 71 was found. The growth as can be seen was about the size of the pituitary body. The value of the specimen lies in the corroborative evidence it gives to the impression gained during the more recent operations that the growing stalk of the lesion comes off from the meninges over the tuberculum.

As the growth emerges from this early symptomless stage, it separates the nerves and bulges backward under the chiasm which is forced to ride astride of it, and in this process the ophthalmologic features of the syndrome under discussion come to be produced. The case histories will have shown, however, that one optic nerve is apt to suffer more than the other, so that mathematically symmetrical bitemporal field defects are perhaps only theoretically to be expected.

From this intermediary stage favorable for operation, the growth in its further enlargement proceeds to do additional damage and to evoke a more complicated clinical picture. The sella becomes absorbed by the pressure, and signs of dyspituitarism may appear; the olfactory sense is likely to become impaired; the third ventricle becomes distorted; secondary hypothalamic symptoms may occur; there may be evidences of uncinate involvement or oculomotor palsies; and ultimately there is apt to be an internal hydrocephalus from occlusion of the foramina of Munro.

The peculiarity, then, of these median suprasellar meningiomas lies in the fact that they ordinarily (we have seen an exception to this rule)

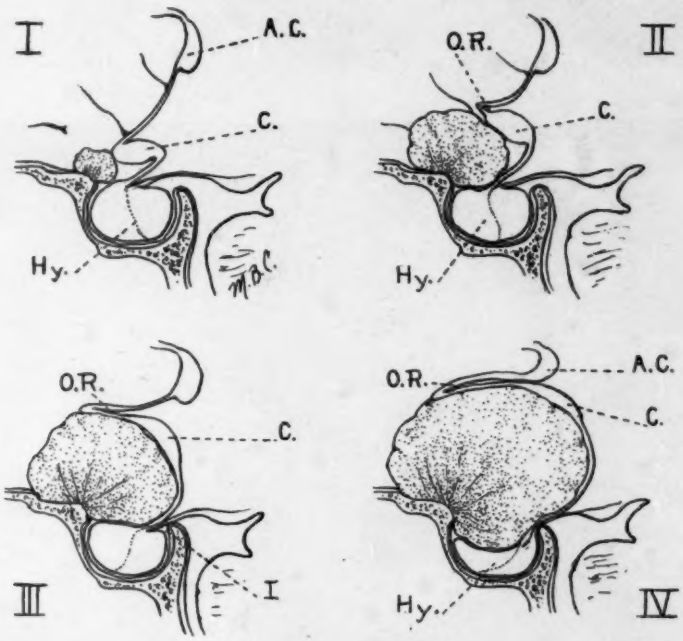


Fig. 70.—Series of drawings to illustrate on sagittal section in four stages the advancing deformation of chiasm and third ventricle: *Hy.*, hypophysis; *C.*, chiasm; *O.R.*, optic recess; *A.C.*, anterior commissure; *I.*, infundibulum. No. *I* is merely a presumptive initial stage. No. *II* is from an autopsy specimen and is possibly presymptomatic. Nos. *III* and *IV* represent the early and late stages producing the syndrome under discussion with tumors from about 10 to 18 Gm. in weight. Anything larger than *IV* is likely to cause hydrocephalus (cf. figure 8).

push the chiasm upward and backward while the optic nerves which are forced to straddle the growth are being separated, flattened and elongated. It is quite otherwise with the meningiomas that arise from a point a little farther forward at the posterior end of the olfactory groove, for the latter lesions, when they attain a size sufficient to compromise the nerves and chiasm, *overlie* these structures and push them downward.

Meningiomas wherever they arise become, as is well known, more or less intimately attached to the adjacent dura, and indeed may even extend through the dura and invade or even pass through the bone into the extracranial tissues. To prevent recurrence of the lesion, surgeons have found it necessary therefore to remove this area of dural attachment within the meshes of which nests of tumor cells are almost inevitably trapped just as they are trapped in the dilated haversian canals when the bone has once become invaded. Though we were well

Fig. 71.—Meningioma of the tuberculum sellae at an early stage—a chance postmortem finding. Note the point of meningeal attachment (*TS*) of the small growth which directly underlies the uncompressed bundle of the chiasm (*C*) and which as yet does not overlie but merely reaches the anterior margin of the hypophysis (*H*). The hypophysis has been tilted upward out of its normal horizontal position during the fixation of the specimen.

aware of this peculiarity of the meningiomas in general, the removal of the dura from over the tuberculum was not attempted in any of these fifteen cases that have been reported; and the postoperative history of case 1 shows at least that an early recurrence under these circumstances need not be anticipated.

We confess, nevertheless, to have experienced some uneasiness as to this possibility, and it will have been gathered from the description of the last step in the operation in case 14 that the area of dural attachment was electrosurgically dehydrated in the expectation of destroying such remaining cell-nests as might have been a potential source of recurrence. Realizing how scanty was our information on this score for the particular meningiomas under consideration, we decalcified the block of tissue from case 5 (cf. fig. 14) and serially sectioned it in an anteroposterior vertical plane. The photomicrographs (figs. 72 and 73) will show that our apprehensions were by no means groundless, for though the tumor had apparently (to the naked eye) been cleanly removed, the meshes of the dura as it lies over the tuberculum contain many nests of tumor cells

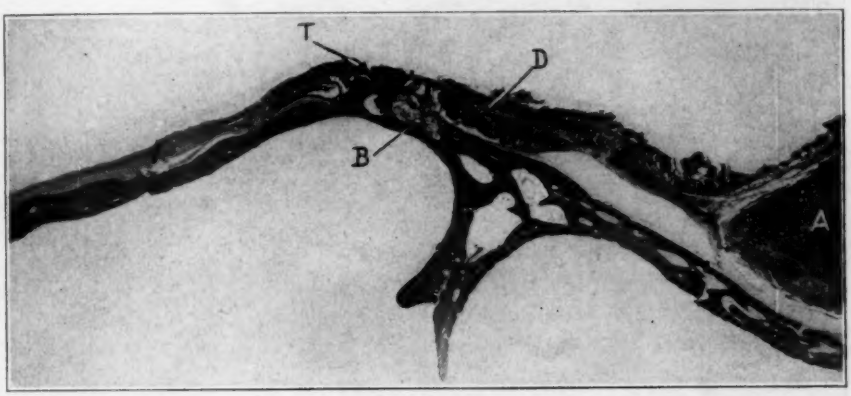


Fig. 72.—Median sagittal section of decalcified specimen shown in figure 14. *T*, tuberculum; *A*, pars anterior; *D*, dura; *B*, bone. Magnification, × 6. The dura can be seen to be invaded by tumor.

which in one place have extended through the dura and have caused slight absorption of the underlying bone.

The Field Defects.—Though a bitemporal hemianopsia has been mentioned as one of the four essential features of the syndrome in question, it is unusual for the field defects to be symmetrical. In only three instances (cases 1, 2 and 13) were they practically equal in the two eyes at the time the patients came under observation. In eight of the patients, one eye had already become wholly blind or the sight was so reduced as to render perimetric observations impossible. Nevertheless, in only one instance (case 7) did the possibility of a preceding homonymous hemianopsia arise; for in all other instances the patients were either subjectively aware of the way in which the blindness had progressed, or fields of vision that had been taken at an earlier stage of

the process made its bitemporal nature clear. In one patient (case 14), we had the opportunity of taking the fields at an early stage when bitemporal defects were present though unequal, and of seeing the patient again three years later before her operation, the more seriously affected eye meanwhile having gone on to blindness.

In practically all the cases in which one eye had become blind the other showed a complete temporal hemianopsia, and it is most improbable that one of these mesially placed meningiomas of the tuberculum should be so asymmetrical in its growth as to cause unilateral blindness, the other eye remaining meanwhile wholly unaffected.

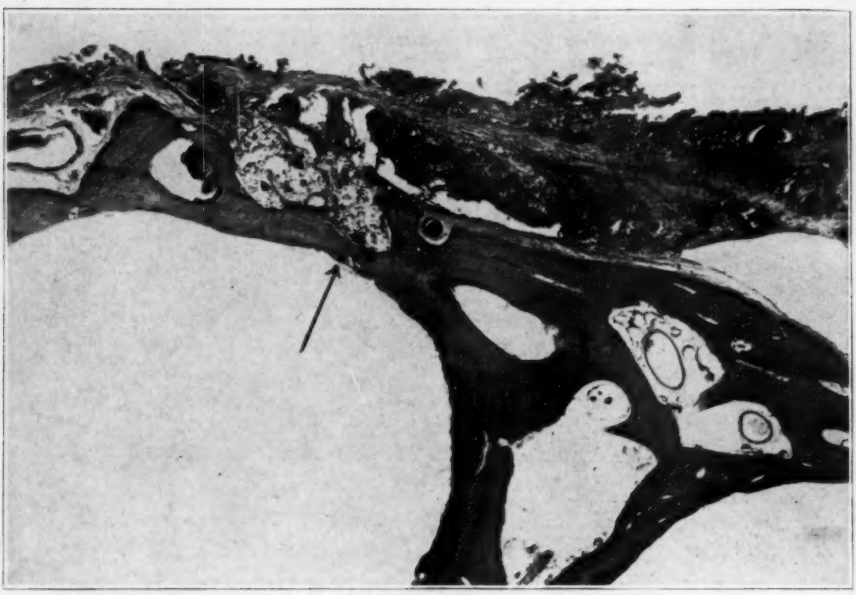


Fig. 73.—Enlargement of site of tuberculum sellae (cf. figure 72), showing extension of tumor through dura and invasion of bone by tumor cells at point indicated by arrow.

But even though the inevitable tendency is toward bitemporal defects, however unequally they progress in the two eyes, it will be evident from the fields that have been given before and after operation, that the nerves suffer more than the chiasm. This is most peculiar in consideration of the extent to which the crossed nerve-bundles must be stretched in the flattened and elevated chiasm. It however is shown by the nearly complete restoration of temporal vision in the good eye in a number of the patients after operation, the other eye remaining blind. Were it a matter primarily of chiasmal damage, should any improvement whatsoever occur after removal of the tumor, one would naturally expect return of func-

tion in the uncrossed bundles of the eye chiefly affected, with restoration of binasal vision. What most often happens, when improvement occurs, is the return of function in the crossed bundle with restoration of temporal vision in the good eye alone.

The fact that the nerves suffer more than the chiasm is further borne out by such bizarre fields as are shown in figure 52 (screen peripheries) and in figure 65, with a horizontal hemianopsia which can in no other way be accounted for than by a prechiasmal compression of the upper fasciculi of both crossed and uncrossed bundles.

The most marked postoperative improvement in the fields occurred in case 13, and the last charts (fig. 58) suggest a residual right lower quadrantal homonymous defect which would indicate that at the operation some permanent damage had been caused to the upper fibers (both crossed and uncrossed) in the left postchiasmal tract. It is quite possible, however, that the suggestively quadrantal defect that shows in the fields of the right eye (screen method) is nothing more than an enlarged blind spot. If this is so, the more complete quadrantal defect in the left eye can be otherwise explained.

DIFFERENTIAL DIAGNOSIS

As may have been gathered from the case histories, a correct pathologic diagnosis has been made before operation in five out of the last seven cases. In cases 1 and 2 no preoperative diagnosis appears to have been ventured on other than of tumor implicating the chiasm. In case 3, owing to absorption of the sella, the finding of a pituitary adenoma was anticipated. The symptoms in case 4 had advanced beyond the possibility of a precise diagnosis. In case 5 a primary glioma of the chiasm was suspected, doubtless under the influence of a contemporary report (1923) on these rare tumors by one of us in collaboration with Dr. Paul Martin.[11] In case 6 the diagnosis lay between adenoma and meningioma. In case 7, though a suprasellar meningioma was considered, this diagnosis was discarded partly on the basis of the unconvincing perimetric field defects and the possibilities of a metastatic tumor. In case 10 there were suprasellar shadows indicating calcification, which strongly favored a craniopharyngeal pouch tumor with symptoms delayed beyond the usual age. Likewise in case 15, not only the patient's comparative youth, but an anomalous sphenoidal cell deforming the usual outline of one anterior clinoid served to cause confusion. In cases 8, 9, 11, 12, 13 and 14 a correct preoperative diagnosis was made. This may be regarded as sufficiently gratifying, but it fails to tell the whole story and wholly neglects those cases in which the diagnosis of meningioma had been made and found to be wrong; for other lesions of the neigh-

11. Martin, P., and Cushing, H.: Primary Glioma of the Chiasm and Optic Nerves in Their Intracranial Portion, Arch. Ophth. **52**:209-241, 1923.

borhood with the same or with a different pathology may cause the syndrome in question or one scarcely distinguishable from it in the present stage of our knowledge.

The notable errors have been chiefly made in suspecting a meningioma when some other disorder was present, which confession merely goes to show that our interest in the subject of these tumors has served as a diagnostic magnet.[12] The principal lesions to be considered in the differential diagnosis are: (1) meningiomas with a parasellar rather than suprasellar point of origin, (2) pituitary adenomas, (3) congenital tumors arising from the craniopharyngeal pouch, (4) gliomas of chiasm and third ventricle, (5) chronic local arachnoiditis, (6) syphilitic meningitis, and (7) aneurysm. In each of them, the three positive elements in the syndrome in question, namely the patient's age, the optic atrophy and the field defects, and the one negative element, the normal sella, are to be considered.

(1) *Parasellar Meningiomas.*—Enough has been said in an earlier section (p. 3) to indicate what may be the differential symptomatology between the meningiomas arising from the tuberculum and those of the lateral or anterior parasellar region. Usually there can be no difficulty in the diagnosis when the growth is in a comparatively early stage; difficulties arise only when the lesion has become of such large size as to mask its primary symptomatology. There may of course be bizarre examples.

(2) *Pituitary Adenomas.*—Here the enlarged sella that is almost invariably present even in the absence of conspicuous pituitary symptoms quickly betrays the probable nature of the lesion even though the patient's age, optic atrophy and field defects might well enough suggest a suprasellar meningioma. However, one meets an occasional case in which, with a sella of normal configuration and size, a suprasellar adenoma has provoked the typical syndrome in question.

---

12. A review of a consecutive series of 100 transfrontal operations for lesions in the vicinity of the chiasm has been made for us by Dr. W. F. Schreiber with the object of determining the percentages of correct and incorrect preoperative diagnoses and the main sources of error. In 16 of the cases the lesion for one reason or another was unverified, the preoperative diagnoses having been: meningioma, 7; craniopharyngeal pouch cyst, 3; adenoma, 3; glioma of third ventricle, 2; osteochondroma, 1. In the remaining eighty-six cases a correct preoperative pathologic diagnosis was made, and the lesion verified in fifty instances (60 per cent) as follows: meningioma, 16; craniopharyngeal-pouch cyst, 16; adenoma, 13; glioma, 4; orbital osteoma, 1. The errors in the remaining thirty-four cases (40 per cent) fall as follows: (1) a preoperative diagnosis of meningioma for proved adenoma, 7; for glioma, 5; for arachnoiditis, 2; for craniopharyngeal-pouch cyst, 2; for chordoma, 1; for aneurysm, 1; for osteogenic sarcoma, 1; (2) a preoperative diagnosis of craniopharyngeal-pouch cyst for proved third ventricle glioma, 4; adenoma, 3; meningioma, 2; arachnoiditis, 2; (3) a preoperative diagnosis of glioma for proved craniopharyngeal-pouch cyst, 2; arachnoiditis, 1; angioma, 1.

(3) *The Craniopharyngeal-Pouch Tumors.*—Being congenital, these lesions usually show themselves by symptoms early in life, and they are commonly associated with secondary dyspituitarism. The sella is apt to be deformed, or even enlarged if the tumor happens to lie within it; and in approximately 80 per cent of the cases the nature of the lesion is betrayed by suprasellar shadows of calcification which the x-rays serve to disclose. It is exceedingly rare for a meningioma, even when highly psammomatous, to cast corresponding shadows (cf. case 10), almost as rare as it is for a pituitary adenoma to do so. Certain of these Rathke's pouch tumors nevertheless fail to cause any symptoms until middle age, and we have recently met with an example in a woman of 62 years. When under these circumstances the lesion has neither undergone calcification nor deformed the sella, it can scarcely be differentiated from a meningioma.

(4) *The Gliomas of the Chiasm.*—These tumors are, comparatively speaking, rare. They may show themselves at any age, but those in our series (sixteen in all) have mostly given symptoms in childhood or young adult life. They may occasionally be identified by a characteristic distortion of the anterior clinoid processes with widening of one or both optic foramina. It is very unusual for the field defects associated with these tumors to be bitemporal in character.

(5) *Gummatous Meningitis.*—Intracranial gummas of all sorts have become so infrequent that they need hardly be considered, though it is probable that all patients victimized by the symptoms under discussion would in years gone by have been given the vigorous antisyphilitic régime to which a few of those in the present series were subjected.

(6) *Chronic Cisternal Arachnoiditis.*—Though this, apart from a postmortem examination, must always be a questionable diagnosis, cases nevertheless are encountered in which, due probably to some previous inflammation, a local accumulation of fluid trapped in a thickened arachnoid membrane may give symptoms of tumor. This is perhaps more common in the cerebellopontile recesses or the posterior cerebellar cistern; in a few cases, however, in which a suprasellar lesion was suspected on the grounds of the syndrome under discussion, nothing was found but a local collection of slightly xanthochromic fluid, the evacuation of which led to a subsidence of symptoms.

(7) *Aneurysm.*—In one case diagnosed both by Dr. Derby and ourselves as a probable meningioma, the operation disclosed an aneurysm about the size of a cherry overlying the chiasm. Ordinarily, aneurysms in this region are not difficult of detection, as they are apt to cause oculomotor palsies and other characteristic symptoms (cf. Symonds [13]).

13. Symonds, C.: The Clinical Study of Intracranial Aneurysms, Guy's Hosp. Rep. **73**:139-158, 1923.

THE LITERATURE ON THE SUBJECT

The literature, with the single exception of a recent notable article by Holmes and Sargent,[14] is exceedingly meager. Unquestionably the tumors are far more common than has been supposed, and though they are not always accurately described, it is possible to identify a goodly number of them in the writings of the past that deal with pituitary tumors.

Naturally enough the earlier reports, such for example as the well recorded case of James Stewart [15] (1899), give the terminal picture of the malady when allowed to run its full course of eight years with complete blindness before the end. Another Montreal case which had advanced to a fatal issue was pictured by Archibald [16] (1908), but the clinical notes are scanty. A typical example of a lesion at about the stage to produce the syndrome under discussion was recorded some years ago (1914) by Heinrichsdorff; [17] the growth (fig. 74) called a psammoma about the size of a cherry, which had taken its origin from the dura between the optic foramina, was an unsuspected postmortem finding in the body of a woman who died of arteriosclerosis. In 1916, Livierato and Cosmettatos [18] gave an account of another case which had been found at autopsy after an attempt to expose the lesion by a subtemporal exploration, with fatality; it, too, was described as a psammoma of the pituitary body the size of a large nut.

The status of the subject in 1922, so far as the senior author could formulate it, was crudely expressed in the quotation which occurs in the "comment" following case 1. That surgeons were beginning to explore the region of the chiasm in the absence of a distended sella or other evidences of pituitary involvement was apparent from an article published in that same year (1922) by W. E. Dandy,[8] who, in a paper dealing with what were called "prechiasmal tumors," *i.e.*, growths involving the prechiasmal segment of the optic nerves, gave an account of two cases, in one of which two symmetrically placed endotheliomas (psammomas) were found surrounding each optic nerve in cufflike fashion, and associated with an accumulation of fluid in the local cisterna around which the optic nerves were greatly stretched. The lesion in his other

14. Holmes, G., and Sargent, P.: Suprasellar Endotheliomata, Brain **50**:518-537, 1927.

15. Stewart, J.: The Symptomatology of Tumors Involving the Hypophysis Cerebri, Tr. A. Am. Phys. **14**:282-289, 1899 (case II).

16. Archibald, E.: Surgical Affections and Wounds of the Head. Bryant, J., and Buck, A.: American Practice of Surgery, New York, William Wood & Company, 1908, vol. 5, pp. 3-378 (p. 332, figs. 87 and 88).

17. Heinrichsdorff, P.: Ein Psammom im vorderen Chiasmawinkel, Klin. Monatsbl. f. Augenh. **16**:185-187, 1914.

18. Livierato, S., and Cosmettatos, G.: Sui tumori della regione ipotalamica del cervello intermedio, Riforma med. **32**:449-461, 1916.

case was not verified, and as it occurred in a boy 8 years of age, the chances would be in favor of a craniopharyngeal-pouch lesion rather than a suprasellar meningioma. The author, however, concluded that the tumors in both cases arose from the reflection of the dura at the optic foramina.

In 1924, Sargent,[19] in a general article on the surgery of the pituitary gland, briefly cited five examples of "suprapituitary endotheliomata," three of which had been exposed by a transfrontal operation and the tumors partly removed, whereas in the other two the symptoms were far advanced and recourse was had to a simple subtemporal decompression. The first of these latter cases which well illustrates the terminal

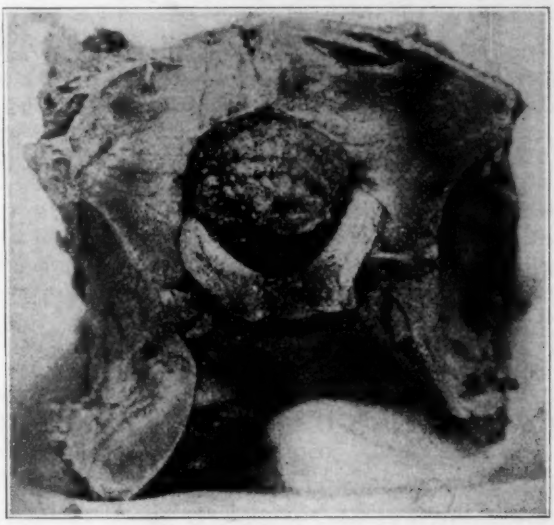


Fig. 74.—Heinrichsdorff's case of psammoma arising from the dura between the optic nerves—an accidental postmortem finding. The nerve on the left is obviously more involved than that on the right.

stage of one of these tumors when allowed to run its course, will be referred to later. In Olivecrona's [20] recent monograph (1927) dealing with intracranial tumors in general, will be found an account of another advanced case which was exposed at operation and a fragment removed for verification.

Doubtless a more thorough search would bring to light the reports of other isolated cases, but these few references will suffice to illustrate what was spoken of earlier in this paper, namely, the inevitable tendency,

19. Sargent, P.: Some Points in the Surgery of the Pituitary Gland, Brit. J. Surg. **11**:521-532, 1924.

20. Olivecrona, H.: Die chirurgische Behandlung der Gehirntumoren, Berlin, J. Springer, 1927, p. 344 (case 42).

out of the diffuseness which has surrounded the general subject of intracranial tumors in the past, for writers gradually to converge on the behavior of a particular tumor in a particular place.

For the tumors in question this step, as stated, has recently been taken (1927) by Holmes and Sargent [14] in a paper read before one of the sessions of the combined meeting of British and American neurologists held a year ago at the National Hospital in London. In this article, in which ten cases of "suprasellar endotheliomata" were reported, the authors (as we have done) included a number of examples in which the tumors obviously had reached such a large size that the syndrome exceeded that which we wish particularly to emphasize. Their first case, alluded to as having been previously reported by Sargent, is a good example of this:

"The patient, a man, 41 years of age, had been under observation for eleven years for failing vision. He had become completely blind in the left eye after about three months and in the right eye after ten years. No other symptoms, local or glandular, were observed until the onset of the general pressure symptoms some three months before death. The chiasm and optic nerves were stretched over the tumor, which was spherical and 3.2 cm. in diameter. It was only loosely connected with the membranes" (Sargent, 1924).

The sella ultimately showed evidence of absorption; the patient became drowsy with subnormal temperature, slow pulse, adiposity and increased sugar tolerance (secondary hypophysial symptoms?); there were headaches, giddiness and vomiting. Death took place shortly after a bilateral subtemporal decompression. The growth, which rested upon the diaphragm sellae, "was attached only to the dura near the anterior clinoid processes" (Holmes and Sargent, 1927).

The nine other tumors described in this important paper were all exposed by a transfrontal route similar to that which we have employed. One patient apparently was operated on in May, 1914, which represents the earliest recorded partially successful surgical exposure of one of these tumors by an osteoplastic exploration with recovery.[21] The lesion, however, in this as in the succeeding seven cases was only fragmentarily removed, it being evident from the brief clinical histories that several of the tumors were of sufficiently large size to have produced symptoms such as uncinate attacks, epileptiform convulsions, pressure phenomena, etc., in other words, a more advanced syndrome than that here primarily under consideration. The operations, however, appear to have been increasingly radical until in the last case in which Mr. Sargent performed an operation on Jan. 5, 1927, two years after the onset of symptoms, the entire tumor, 2.5 cm. in diameter, was successfully dislodged with subsequent improvement in vision.

---

21. Krause's patient (Chirurgie des Gehirns und Rückenmarks, p. 78, plate xviii) was operated on apparently in 1904, with fatality. It is difficult to tell from the description whether it was an olfactory groove tumor or a strictly suprasellar lesion.

PROGNOSIS

Without operation one may possibly predict an interval of ten years from onset of symptoms to blindness or worse. With operation, and there is no other possible form of treatment (since meningiomas are not apparently influenced by radiation) there are certain risks: (1) of a fatal issue, (2) of further damage to vision from trauma to the nerves, (3) of causing a postoperative diabetes insipidus. These risks, however, should become reduced to a minimum as the result of earlier intervention and increased experience with the operative procedure.

Barring a fatal accident such as occurred in case 5, the histories of the cases in which the tumor was sufficiently well exposed to justify an attempt at radical extirpation show that the outlook for vision is good. Only in the first of the cases was it apparent that additional damage to the nerves had been brought about by operative trauma, whereas in the other eight cases in the series in which similar treatment was employed there was almost invariably improvement, often promptly appreciated, and shown not only by an increase of visual acuity, but by widening of the fields.

That improvement may occur even when vision is so seriously impaired and for so long a time as it was for example in case 12 goes to show that transmission of impulses in fiber tracts of the optic nerve may be wholly interrupted by pressure and the disk show the pallor of supposed atrophy and yet the nerve may be capable of functional recovery.

In view of the inevitable compression of the third ventricle with flattening and elongation of the infundibulum, one might expect that the dislodgment of the posterior shell of the lesion would almost inevitably contuse these structures and be likely to cause a postoperative traumatic polyuria. That such an accident is possible is evident from the histories of the two patients, in one of whom (case 14) a transient, and in the other (case 10) a more enduring, postoperative polyuria was observed. In case 10, however, unusual difficulties were met with in removing the final fragment of the growth, and the fact that in the other several cases in which the extirpation was completed there was no evidence of hypothalamic injury shows that these complications need not greatly be feared. One structure, however, the right olfactory nerve, is almost certain to be injured during the operation, but the resultant unilateral anosmia which causes the patient no annoyance and of which he usually remains unaware is a small price to pay for preservation of vision.

TREATMENT

Since the real purpose of this paper is to emphasize a particular clinical syndrome due to tumor, the surgical aspects of the problem need not long detain us, though some description, however brief, is called for to clarify the cursory operative notes in the case histories.

As in all procedures destined to uncover an intracranial growth, two questions arise: (1) What is the best method of exposure? and (2) What shall be done with the lesion when it is brought to view? Though the latter is by far the most important consideration, it is to the former that most attention in the beginning is usually paid. The pioneers blaze various trails into a new country; their followers, the settlers who develop it, instinctively take the shortest and safest route.

Several intracranial ways of access (subtemporal; semilateral; and frontal whether bilateral or one-sided) to the chiasmal and pituitary region have been described and have their advocates. Most of these operations are alike in that they call for a preliminary osteoplastic bone flap; they differ largely in the position of the flap, in the extent to which the brain is laid bare and in the amount of elevation necessary to bring the chiasm into view.

All more or less complicated operations of this sort tend toward simplification and unification for the reason that those who are called on to conduct them have a common goal, namely, to develop a procedure which gives the most direct access to the lesion and entails the least possible risk of contusion to the brain. Our personal preference is strongly in favor of the unilateral osteoplastic subfrontal and largely extradural exposure shown in the accompanying illustrations (figs. 75, 76, 77 and 78). With minor modifications, it is the same method that has been employed by Krause,[22] Frazier,[23] Sargent [18] and others. It is particularly adaptable for the exposure of the mesially placed tumor under discussion.

There may be some question as to whether a right or left frontal flap should be reflected, and surgeons (e.g., Sargent) have apparently been influenced in their choice by whether one optic nerve has been more impaired than the other. Dandy in operating for pituitary adenomas even goes so far as to recommend the purposeful sacrifice of the nerve chiefly involved in order to get a better exposure of the tumor, which possibly is more necessary in the semilateral approach of Heuer, which he favors. As a matter of fact, the approach by the subfrontal method is so nearly a direct anterior one that the question of a right or left frontal flap makes little difference. And since it is far easier for a right-handed person to work from the right, this has been the side preferred. The important thing is the preservation from trauma of the flattened nerves and chiasm during the manipulation and final dislodgment of the tumor, and were there any choice of sides it would seem preferable to work from the side of the less impaired nerve, so that it can be continually under observation.

---

22. Krause, F.: Chirurgie des Gehirns und Rückenmarks, Berlin, Urban & Schwarzenberg, 1908, vol. 1, p. 176 (p. 76 et seq.).

23. Frazier, C.: An Approach to the Hypophysis Through the Anterior Cranial Fossa, Ann. Surg. **57**:145-150, 1913.

To a few matters of secondary importance attention may be drawn. The vertical leg of the incision (fig. 75) in the scalp should be exactly in the midline if an invisible scar is to be secured. This is connected with the curved incision along the eyebrow by a short oblique cut across the corrugator supercilliae muscle, which is carefully drawn together at the time of closure. Should the frontal sinus be opened in making the

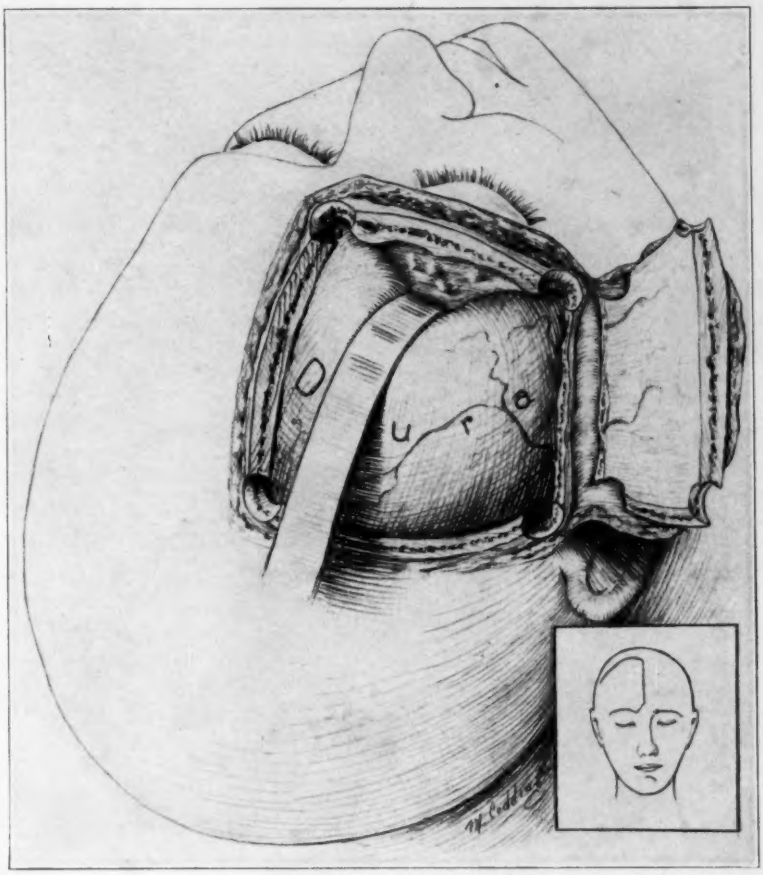


Fig. 75.—Showing the incision, position of flap and elevation of dura from the orbital plate at an early stage of the procedure (greatly reduced).

burr opening at the inner angle, the mucous membrane may often be brushed away and preserved intact. Even should the sinuses be opened by the Gigli saw in cutting the lower leg of the flap, which should be reasonably near the supra-orbital ridge, they may be effectively covered at the conclusion of the operation by a small patch of dura or of fascia, which prevents subsequent leakage of cerebrospinal fluid into the nose. Particular care must be taken in separating the dura from the bone, for in

these middle-aged patients it may be extremely thin and adherent and the inner surface of the bone irregular. Special mention of this was made in the record of cases 11, 13 and 14.

After elevating the dura from the orbital plate and putting it on tension where it adheres tightly to the posterior edge of the lesser sphenoidal

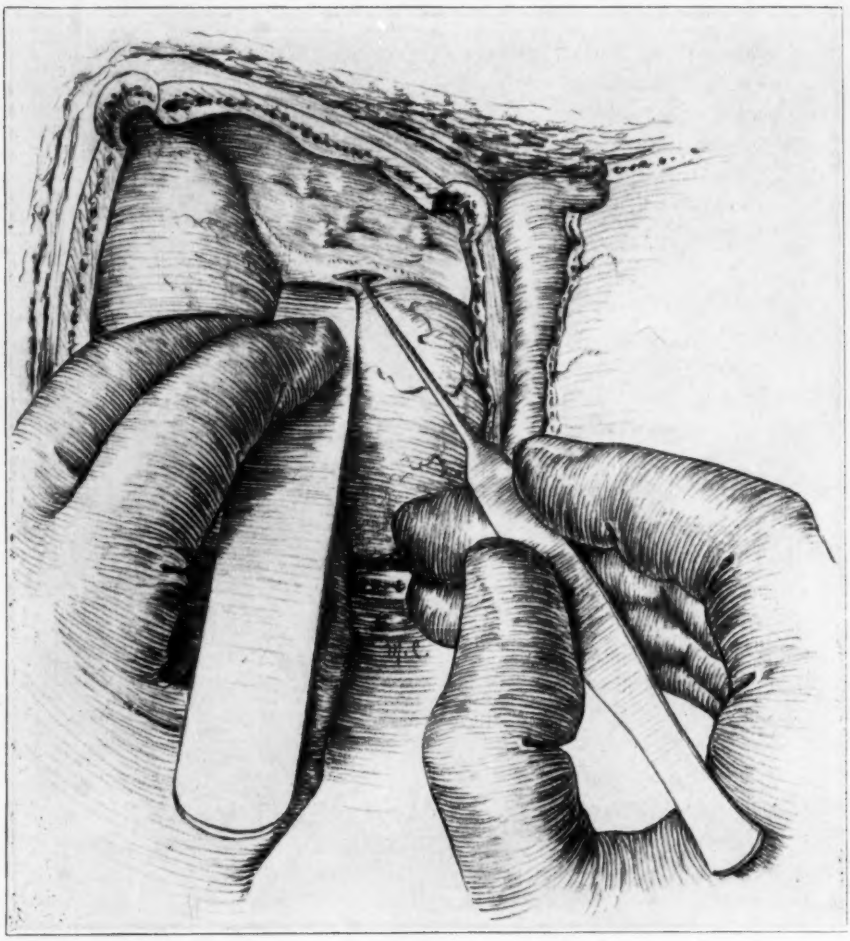


Fig. 76.—Showing the dura put on the stretch at its line of firm attachment to the sphenoidal ridge and the primary opening with a hooked knife into the fluid-containing spaces, which promptly lowers tension. (Slightly reduced).

wing (fig. 76), the membrane is pricked by a hooked knife and an abundance of fluid is usually secured which renders unnecessary a puncture of the ventricle. The dural incision is then carried outward to the sylvian angle and inward about to the anterior clinoid, where an anterior

cut is made forward along the firm attachment of the membrane to the right olfactory groove. The frontal lobe during the remainder of the procedure is supported by the dural flap.

The nodular anterior margin of the tumor (fig. 77) that curves between the optic nerves is unmistakable when once recognized. The next step of the operation consists in nibbling away the anterior portion of the growth until its attachment to the tuberculum is freed. When its

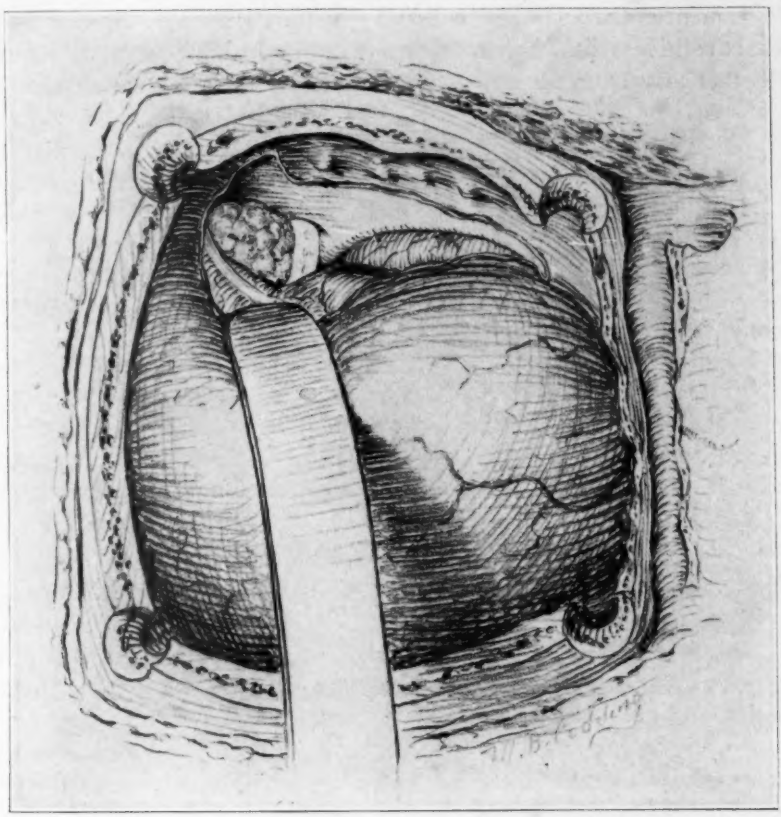


Fig. 77.—Showing the primary exposure of right optic nerve and adjacent lesion.

bulk is sufficiently diminished, the tumor can be tilted out from under the chiasm without further stretching of the delicate and flattened nerves. Precaution should be taken at this last step of the enucleation not to damage the elongated infundibular stalk which in some cases (cf. figs. 30 and 48) has been clearly exposed in the bed of the tumor after its removal.

Patients under local anesthesia sometimes, though not always, complain of pain in the eyes during these manipulations of the tumor and recourse to inhalation or rectal anesthesia must be resorted to; but this is undesirable if it can be avoided, for it usually increases tension.

In the last few operations it has been found that the preliminary steps of excavating the anterior portion of the growth can be greatly facilitated by electrosurgical methods (fig. 78) and the employment for the purpose of a small Bovie wire loop. At the conclusion of the enucleation, the dura over the tuberculum should be carefully brushed by the loop (cf. case 14) to insure dehydration of any remaining nests of tumor cells that may lie in its meshes. On replacing the flap care should be

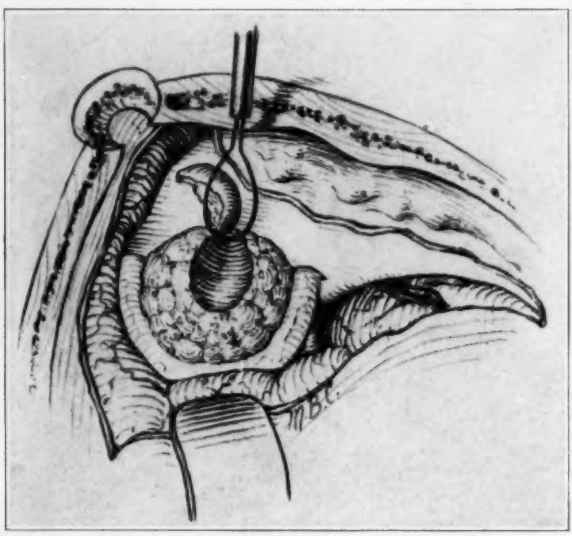


Fig. 78.—Showing the primary step of excavating the tumor at its point of attachment by electrosurgical methods.

taken to draw together the edges of the pericranium particularly over the lower midline burr opening (which should have been made as small as possible) so as to prevent the dimple that otherwise may gradually appear at this conspicuous site.

CONCLUSION

The meningiomas that arise from the basilar leptomeninges in the vicinity of the pituitary fossa do not as a rule cause the reactive hyperostosis that so often makes it possible to determine the exact point of origin of meningiomas elsewhere in the cranial chamber. They are consequently more difficult to recognize and precisely to localize, and if

they are to be picked up at a stage when they are easily removable, this can be accomplished only by full knowledge of the symptom-complex they produce.

Owing to the fact that these tumors are prone to cause primary optic atrophy, they are of especial importance to ophthalmologists. Some of them arise from the sphenoidal ridge lateral to the sella, press against the adjacent optic nerve, and finally implicate the chiasm causing a homonymous hemianopsia. Others arise from the olfactory groove and, as one of us has taken pains recently to point out,[4] provoke a characteristic chronology of symptoms beginning with unilateral anosmia followed by an ipsolateral optic atrophy and ultimately by a choked disk in the contralateral eye. This combination of signs and symptoms known as the Foster Kennedy syndrome is unmistakable, though the olfactory groove tumors may reach an enormous size before their presence is suspected.

In a third group of meningiomas—those under discussion—which arise from the arachnoid over the tuberculum sellae, the ophthalmologic symptoms are produced while the lesion is still small and easily removable. In the progress of their growth these mesially placed tumors separate the optic nerves, elevate the chiasm, and ultimately lead to blindness, to absorption of the sella, to hypopituitary, hypothalamic, ucinate and general compression symptoms; but in the stage in which they are favorable for operation, they are associated with a characteristic syndrome whose essential elements are as follows:

(1) *They occur in patients of middle age* as do most meningeal tumors, the average age of the 185 patients with meningiomas of all situations in our series being 42.5 years at the time of their first hospital admission.

(2) For obvious reasons, impairment of vision is the earliest and usually the only symptom of which the patient has occasion to complain. *The fields become bitemporally constricted,* though as a rule the process does not advance with equal steps in the two eyes.

(3) In consequence of the distortion of nerves and chiasm, *a primary optic atrophy* is invariably disclosed by the ophthalmoscope.

(4) At the stage when they are favorable for operation, the tumors *do not deform the sella turcica* nor cause secondary symptoms of hypopituitarism. This fact renders them distinguishable from the general run of hypophysial adenomas which also cause bitemporal hemianopsia and primary atrophy, but which usually arise within and distend the sella.

ABSTRACT OF DISCUSSION

DR. WILLIAM ENGELBACH, St. Louis: I had the privilege of attending for a considerable length of time one of the patients (Mrs. G.) to whom Dr. Cushing referred. Previous to our observations, she had been under the care of many

ophthalmologists. The main sign was a classic optic atrophy, associated with intermittent headaches. Serial detailed eye examinations by numerous ophthalmologists over a number of years failed to produce a positive diagnosis. The unilateral optic atrophy remained stationary under our observation for a number of years without involvement of the perimeter of the other eye. Then finally the patient began to have a contraction of the field of the eye which had previously been normal. At that time, after a series of perimetric readings taken at short intervals, a positive diagnosis of suprasellar progressive tumor was made, and she was operated on by Dr. Cushing, who reported a very good result. We have had her under observation since operation, and there has not been any unfavorable change. Of course she has the optic atrophy present previous to the date of our first observation. Since the operation she has had some improvement in the good eye that had begun to be affected previous to the operation, and she has not had any other symptoms.

INTERSTITIAL KERATITIS WITH UNUSUALLY MARKED CHORIORETINITIS

PATHOLOGIC-ANATOMIC EXAMINATION OF A CASE *

W. P. LING, M.D.
PEKING, CHINA

In reviewing the literature one is struck by the fact that comparatively few cases of interstitial keratitis offer the opportunity for pathologic-anatomic examination. For this reason, whenever materials for such a purpose are available, it is desirable to utilize them for further investigation, in the hope that they may make more clear the conception of this disease, which is as yet by no means well understood. Fortunately, in the present case it was possible to secure the eyeball after the vision was destroyed in spite of treatment. The histologic examination revealed many interesting changes which constitute the subject of this paper.

REPORT OF CASE

History.—A boy, aged 14, came to the Eye Clinic of the Peking Union Medical College Hospital on April 29, 1927, with a history of marked redness, lacrimation, photophobia and impaired vision involving the left eye, which had lasted continuously for six weeks.

The family history was unimportant; as the parents lived in a city quite far from Peking, their blood was not available for a Wassermann test. The patient did not have any idea whether his parents had had any symptoms of syphilis. The past history was unimportant except that when the patient was 6 years old he had an attack of "inflammation" in the left eye, associated with blurred vision, the duration of which he could not recall.

Examination.—General physical examination showed the patient to be underdeveloped and undernourished, weighing 31.7 kilograms. He had Hutchinsonian teeth and chronic purulent otitis media of the right ear, with impaired hearing in both ears. He did not show any physical signs of tuberculosis. The Wassermann reaction was strongly positive. The reaction to the Mantoux test was positive (1-1,000,000).

Eyes: Vision in the right eye was 2/30, but was improved to 6/12 with a —6.00 sphere; in the left eye, counting the fingers was possible at 10 cm., but the vision was not improved by any lenses. The right eye was normal with the exception of a congenital axial cataract and some myopic changes in the fundus. The entire left eye was intensely inflamed. It showed marked pericorneal injection. The entire cornea, but particularly its lower two thirds, was cloudy, owing to diffuse infiltration in its deeper layers, without any vascularization. Precipitates were not observed on its posterior surface. There was no exudate in the anterior

* Submitted for publication, Oct. 29, 1928.

* From the Department of Ophthalmology of the Peking Union Medical College.

chamber. Pupillary reaction was sluggish, but there were no posterior synechiae. Details of the fundus were invisible. Tension was normal.

Treatment and Course.—The patient was referred to the syphilis clinic on May 18, 1927, and treatment with neoarsphenamine alone was begun on May 29. Eight injections given at intervals of one week up to July 12, 1927, totaled 3.50 Gm. These were followed in one week by eight injections, at intervals of one week, of sodium potassium bismuth salicylate, totaling 0.33 Gm. After these injections, the Wassermann reaction in the blood remained strongly positive. On account of financial difficulties, he did not continue the treatment in the clinic but arranged with a friend of his father's, a physician, to have neoarsphenamine given him outside free of charge. He had, altogether, eight such injections outside the hospital at irregular intervals (0.3 Gm. each time). His last Wassermann reaction in the blood on May 5, 1928, was still positive. He came again to the clinic on May 22, 1928, and was given an injection of 0.45 Gm. of neoarsphenamine.

In the course of this treatment, in conjunction with the local use of atropine and hot compresses, the left eye did not show any improvement, but, on the contrary, became worse and worse. The infiltrations became increasingly dense throughout the whole cornea, which gradually assumed the appearance of ground glass. On Sept. 6, 1927, at the end of two courses of antisyphilitic treatment, in addition to a marked pericorneal injection and parenchymal infiltration, the entire cornea showed a large number of fine superficial and deep vessels running in all directions from the limbus toward the center. The anterior chamber and the iris, including the pupil, were both obscured by the pronounced vascularization and infiltration of the cornea. Vision was now reduced to that stage at which movement of the hands could be noted. The right eye continued to be free from the disease.

He was admitted to the ward on December 22 and during the thirteen days he was in the hospital he was given two injections of antityphoid vaccine, totaling 40,000,000 bacilli. His condition did not improve.

As the condition of his eyes was becoming worse, with no prospects of recovery (loss of light projection), it was proposed on Jan. 14, 1928, to remove the eyeball for the relief of his distressing symptoms. Permission had to be secured from his parents, so the operation was not performed until March 14. Examination on this date revealed the following condition: Vision in the right eye was 6/12 with a —6.00 sphere. No pathologic changes except those mentioned previously were noted in the conjunctiva or eyeball. In the left eye there was light perception at 40 cm., with poor light projection in all directions. There was intense conjunctival and pericorneal injection, associated with marked photophobia and lacrimation. The cornea was wholly and densely infiltrated and vascularized. Nothing could be made out behind the cornea. The tension was moderately increased (finger test).

PATHOLOGIC REPORT

MACROSCOPIC EXAMINATION

The eyeball was fixed in Müller's fluid. Its shape was normal. The measurements of its diameters were: anteroposterior, 24 mm.; vertical, 21 mm., and horizontal, 23 mm.

The cornea measured 12 mm. horizontally and 11 mm. vertically. Its curvature was normal. Its surface was perfectly smooth. The sclera was normal in thickness. The optic nerve stump measured 3 mm. long and looked normal.

The eyeball was embedded in celloidin, and vertical serial sections were made in the sagittal plane.

MICROSCOPIC EXAMINATION

Cornea.[1]—Epithelium: With the exception of a small defect near the limbus on one side, probably due to artefact, the epithelium was in fairly good condition, not showing any break in its continuity. While the anterior surface of the epithelium was perfectly even, the posterior surface was wavy. This caused irregularity in thickness: in places it was slightly increased, consisting of six or seven layers of cells, and in others slightly decreased, consisting of two or three layers of cells. The basal cells were present throughout; the cells of the middle layers had disappeared in the thinned parts. The basal cells were separated by narrow spaces (fig. 1).

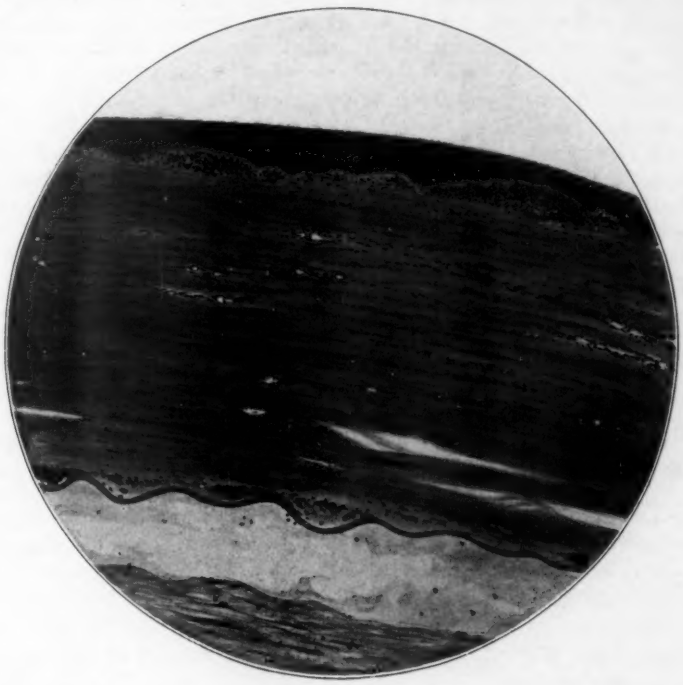


Fig. 1.—Keratitis parenchymatosa. Thinning of the epithelium in places. Corneal stroma vascularized and infiltrated with fixed corneal cells and lymphocytes.

Throughout the entire epithelium the appearance of the cells was not changed. The deeper layers were infiltrated with scattered lymphocytes, a few of which had found their way into the superficial layers.

Bowman's Membrane: At first sight, Bowman's membrane appeared to be largely destroyed, but careful examination of the sections treated with van Gieson stain brought out more of the membrane than could be demonstrated in the sections stained in the ordinary way. Only in a small part near the limbus on one side was the membrane totally gone. The other parts were still

1. Sections stained for Spirochaeta pallida and tubercle bacilli did not reveal any of these organisms.

present, but by no means in a normal condition. In the first place, the membrane was wavy and uneven on both its anterior and its posterior surfaces; in the second place, it was irregular in thickness. Thus, when it passed in front of the cellular nodules which will be described later (this place corresponded to the attenuated part of the epithelium), it became extremely thin and hardly recognizable, simulating a break in its continuity; or it appeared to split up into several thin filaments lying in the cellular nodules. Moreover, at intervals the membrane showed a gradual thinning or constriction on both its anterior and its posterior surfaces, so that it appeared to consist of spindle-shaped segments.

Immediately beneath almost the entire Bowman membrane, there was a layer of cellular infiltration of irregular thickness, consisting chiefly of proliferated fixed corneal cells, among which was a small number of lymphocytes and an occasional eosinophil. At intervals beneath the attenuated parts of the Bowman's membrane, these fixed corneal cells were collected into small elongated nodules of various sizes, and they, together with the overlying Bowman's membrane, bulged forward into the posterior surface of the thinned parts of the epithelium. Most of these infiltrating corneal cells in the form of either diffuse infiltration or nodules, were lying behind the Bowman's membrane. In some places, they replaced or concealed the membrane; in others, they lay between the splitted filaments of the membrane or between the membrane and the epithelium. The entire layer of fixed corneal cells contained, here and there, minute capillaries which were most numerous in the cellular nodules just described.

Substantia Propria: The lamellae of the corneal stroma were well preserved, in spite of the long duration of the disease and the severity of the clinical signs. In the substance of the stroma, pronounced and extensive changes had occurred, consisting of cellular infiltration and vascularization, which affected all the layers. Both the marginal and the central portions of the stroma were involved. The cellular infiltration was composed chiefly of fixed corneal cells; a few lymphocytes and eosinophils were found in all the layers. The corneal cells possessed a typical oblong nucleus and a polymorphous protoplasmic body which was round, oblong, oval or fusiform. They gathered themselves around the newly formed blood vessels, and appeared as streaks or oval areas of cellular accumulations. The blood vessels were of the capillary type, running parallel with the lamillae. They did not show any changes in their walls.

Throughout the entire stroma it was impossible to find necrotic areas observed by Elschnig[2] and Watanabe.[3] Widening of the interlamellar spaces, as observed by the same authors, also was not noted.

Descemet's Membrane: Descemet's membrane was intact throughout. On one side, it was moderately wrinkled and separated partially from the corneal stroma. The spaces thus produced were filled with small nodules of fixed corneal cells, a few lymphocytes and an occasional eosinophil.

Endothelium: The endothelium was present in an almost continuous layer on one side up to the pupillary area. On the other side, it was practically absent, although a few cells were seen in the region of the filtration angle.

On the posterior surface of the cornea, small accumulations of lymphocytes were observed here and there, which clinically would appear in bedewing spots.

---

2. Elsching: Ueber Keratitis parenchymatosa, Arch. f. Ophth. **62**:481, 1906.

3. Watanabe: Pathologisch-anatomischer Befund bei Keratitis parenchymatosa syphilitica congenita mit besonderer Berücksichtigung der Neubildung von Bindgewebe an der Hinterfläche der Hornhaut, Klin. Monatsbl. f. Augenh. **52**:408, 1914.

Sclera.—The changes in the sclera were distributed in three almost well defined regions; namely, anterior, middle and posterior. In the anterior region, dense infiltration was seen, chiefly with fixed scleral cells around the hyperemic vessels near the cornea. The infiltration was limited chiefly to the outer layers of the sclera and the episcleral tissue, and it gradually decreased in intensity backward and up to the region of the equator. The same kind of cellular infiltration was evident along the vortex veins in the middle region, and it extended backward along the course of these veins, even when the latter were no longer visible. In the posterior region, the same kind of cellular infiltration involved principally the layers of sclera next to the choroid and suprachoroid. So in this part of the sclera the changes were considered as a direct effect of those taking place in the latter two structures.

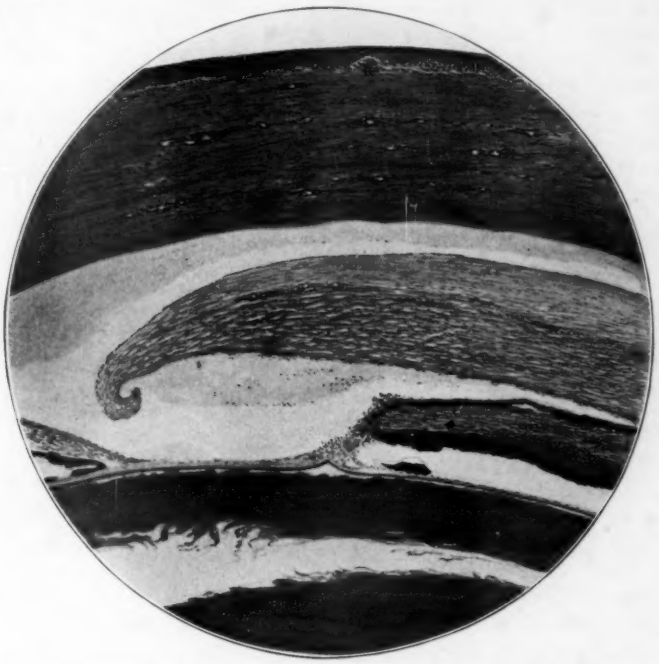


Fig. 2.—Keratitis parenchymatosa. There is a thick piece of connective tissue membrane in the anterior chamber, one end of which is free and curled up. The pupil is occluded by a thin layer of connective tissue.

Anterior Chamber and Filtration Angle.—The anterior chamber was shallower than normal. In its anterior part, some fibrinous exudate was observed adhering to the posterior surface of the cornea and containing scattered lymphocytes and polymorphonuclear leukocytes. On one side, behind that part of the Descemet's membrane from which the endothelium had practically disappeared, there was a thick piece of newly formed connective tissue membrane which was more than half the thickness of the cornea (fig. 2). This membrane began in the filtration angle on the corresponding side, which it completely obliterated. It extended from there toward the center of the chamber to as far as the pupillary margin on the opposite side, where it tapered off and the tip became curled up. In structure it closely

resembled the corneal stroma. Like the latter it was composed of lamellae arranged parallel to one another. Between the lamellae there were many cells with pale and elongated nuclei, which were indistinguishable from the fixed corneal corpuscles. The interlamellar spaces were wider, however, than those in the corneal stroma, and the lamellae were stained less deeply than the corneal stroma. The membrane was vascularized in the same way as the cornea, with an increase of fixed cells around the blood vessels. A small number of lymphocytes, plasma cells and eosinophils was present, especially on its surface and free margin.

In the filtration angle where it began, the membrane was adherent to both the cornea and the iris. Toward the center of the chamber it was separated from the cornea by a narrow space containing some fibrinous exudate but continued to be partially adherent to the iris up to the vicinity of the pupillary margin on the corresponding side. Then, as has been said, it terminated in a free end, which curled up opposite the pupillary margin on the other side.

The filtration angle on the opposite side was open but narrower than normal.

The pectinate ligament was infiltrated with a moderate number of lymphocytes. Schlemm's canal on either side was densely infiltrated with lymphocytes, with normal lamellae between it and the filtration angle.

Iris.—The iris was not atrophic. The sphincters were visible. The blood vessels were in a normal condition; proliferation of the vascular endothelium was not observed. The pupillary margin on the two sides was adherent to the anterior lens capsule, and the pupil was closed by a thin piece of connective tissue lying on the anterior lens capsule and continuing on to the pupillary margin on both sides. The body of the iris arched slightly forward on both sides. Its root and anterior surface on one side was adherent to the pectinate ligament and the membrane in the anterior chamber. On the opposite side, the anterior surface of the iris was covered by a thin layer of mononuclear cells. The whole parenchyma of the iris was infiltrated diffusely with some lymphocytes, plasma cells and a few eosinophils. The lymphocytic infiltration was denser in the posterior and root parts of the iris.

Ciliary Body.—The ciliary body was moderately atrophied. Its parenchyma was practically free from cellular infiltration, except in the vicinity of the iris root and ora serrata, where there were accumulations of a small number of lymphocytes. The blood vessels were moderately hyperemic. The pigment epithelium was intact. Nodules of lymphocytes were noted on the nonpigment epithelium in the middle of the pars plana, between it, on one hand, and the vitreous membrane and the zonula fibers, on the other.

Choroid.[4]—Practically the whole choroid was involved in the pronounced and extensive changes, which affected more the outer than the inner layers. They consisted essentially of widespread lymphocytic infiltration between and around the large blood vessels, complicated by marked secondary changes. The infiltration was of two kinds with regard to its severity. In the first kind of infiltration, the lesion was confined to the parenchyma of the choroid within the boundary line of the lamina vitrea, and consisted of more or less diffuse infiltration with lymphocytes. The choriocapillaries were, however, mostly free from this involvement. In the second kind of infiltration, the lesion was more prominent and extensive. It not only involved the whole thickness of the choroid but also extended through the lamina vitrea toward the retina. In this case, the lesion consisted of large lymphocytic nodules occurring at intervals along the choroid. These nodules were more or less pyramidal with the apex projecting into the overlying retina. They were

4. Sections stained for Spirochaeta pallida and tubercle bacilli did not reveal these organisms.

partially organized and formed adhesions with the retina (fig. 3). They contained some pigment granules and an occasional giant cell. Epithelioid cells were not visible. Caseation was not noted.

The foregoing changes were referred to the more peripheral parts of the choroid. But on both sides of the optic disk to an extent of about two papillary diameters, the choroid showed changes which merit special mention. Here, it showed dense diffuse infiltration with lymphocytes, without the formation of nodules as those described previously. Then, between the choroid and the retina, there was a thick layer of newly formed connective tissue, with long fusiform nuclei parallel to one another. This connective tissue membrane had a hyaline appearance. The choroid

Fig. 3.—Choroiditis disseminata in parenchymatous keratitis. The choroiditic nodule is partially cicatrized and adherent to the retina. The lamina vitrea is not broken through. The retina is degenerated.

merged into this membrane imperceptibly; it was irregular in thickness—in one place, half as thick as the sclera—and was totally adherent to the overlying retina (fig. 4).

The blood vessels were largely intact. In some places, where the infiltration was dense, they were not visible. The choriocapillaries were present almost throughout.

In spite of the severity of the changes in the choroid, the lamina vitrea was present almost everyhere, although in many places it was split up or composed of spindle-shaped segments, as Bowman's membrane. Even in the chorioretinal nodules it was visible, as can be demonstrated by the van Gieson stain. It was broken through in only two places.

The pigment epithelium was visible except that it disappeared from view at the margin of the chorioretinal adhesions and in the juxtapapillary chorioretinal lesion. Where the epithelium was visible, the pigment granules were seen to collect on the side toward the retina.

Retina.—The retina revealed a considerable amount of degeneration affecting particularly its outer layers; it was adherent here and there to the choroid. The rods and cones were practically gone. The outer and inner nuclear layers contained fewer nuclei than normal; the internuclear layer was atrophied. These layers were all markedly disorganized and much folded over the juxtapapillary chorioretinal lesion. There were few ganglion cells. The nerve fiber layer was edematous and degenerated. A considerable degree of perivascular infiltration with lymphocytes was noted, not only in the vicinity of the chorioretinal adhesions, but also in places remote from these.

Optic Nerve.—The optic disk did not show any glaucomatous cupping. On the contrary, it was swollen and edematous, and covered by a thin layer of connective tissue. The arteries and veins were congested. The extra-ocular portion of the nerve showed beginning atrophy, with increase of glia cells. The dural and pial sheaths were normal. The arachnoid was infiltrated with scattered mononuclear cells, more densely near the eyeball.

Lens.—The lens capsule and the lens substance were normal. On the posterior surface of the lens were some cells, mostly large mononuclear leukocytes, and pigment macrophages, which were present also between the zonular fibers.

Vitreous Body.—The vitreous body contained some scattered mononuclear cells near the ciliary body and the lens. On one side it showed a network of fibrin-like material.

COMMENT

The case of interstitial keratitis reported here represents, no doubt, an unusual example of the disease, both in its clinical course and in its pathologic changes. Practically all the cases of interstitial keratitis encountered in the clinic end with the patient's recovery of a certain amount of useful vision; in some cases this recovery is almost complete, although the course of the disease is often extremely prolonged and seemingly disappointing. The patient's behavior in this case was different from that of others I have observed in China. From the beginning, the symptoms were violent and the changes in the eye were progressively unfavorable, leading to practically total blindness within a year's time. The clinical picture of interstitial keratitis varies widely in different persons with regard to its severity, but the ultimate outcome is, as a rule, more or less favorable to visual function, as was, also, the experience of Igersheimer.[5] Therefore, in the present case the question may be asked whether it can be explained entirely on a syphilitic basis. Clinically, the evidence seems to point to the correctness of this assumption. Undoubtedly, the patient had congenital syphilis, as shown by his

5. Igersheimer: Ueber die weiteren Schicksale von Patienten mit Keratitis parenchymatosa, Ophth. Ges. Heidelberg, 1913, p. 251; quoted from Lehmann: Ztschr. f. Augenh. **62**:234, 1927.

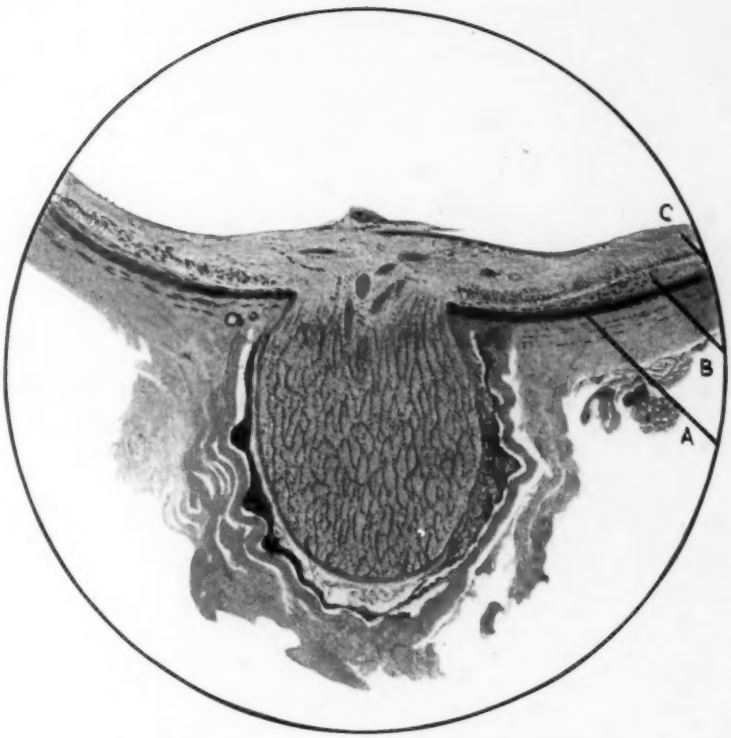


Fig. 4.—Retino-choroiditis juxtapapillaris. *A* indicates choroid with lymphocytic infiltration; *B*, connective tissue between choroid and retina, and *C*, degenerated retina.

age, his development, the strongly positive Wassermann reaction and the Hutchinsonian teeth. The positive reaction to the Mantoux test does not speak against that assumption, because the patient may have had a coexisting tuberculous focus somewhere in his body including, of course, the eye. The fact that he did not respond to antisyphilitic treatment cannot be taken to mean that his condition was not due to congenital syphilis, because (1) it is well known that congenital syphilis—and, hence, interstitial keratitis on this basis—may not be greatly influenced by any treatment, and (2) the treatment was not intensive enough in this case. On the whole, the clinical signs and symptoms of the congenital syphilis in general, and those of the ocular disease in particular, permitted a diagnosis of interstitial keratitis on that basis.

Another question may be asked, whether the tuberculous infection of the body, as shown by the positive reaction to the Mantoux test, had anything to do with the prolonged course of the disease leading to ultimate blindness. It is extremely probable that the coexistence of the two infectious processes, tuberculosis and syphilis, so impaired the general resistance of the body that little evidence of a tendency to healing was found either clinically or microscopically, and hence the outcome was total blindness.

In the present case, the eyeball was enucleated after the keratitis had existed for one year. In cases previously reported by such authors as Jäger,[6] Elschnig,[2] Reis [7] and Watanaba,[3] the duration between the onset of the disease and the enucleation varied from two to eight months; in those reported by Stanculeano,[8] von Hippel,[9] Kunze [10] and Gilbert [11] it varied from one to ten years. In view of these variations, it is not surprising to find many discrepancies in the microscopic observations. Gilbert [11] rightly said that the histologic evidence in interstitial keratitis of congenital syphilitic origin has shown that there is not any uniform anatomic picture for this disease; much depends on its course, duration and other clinical factors.

At any rate, the microscopic changes in the present case were interesting, concerning chiefly the cornea and the uveal tract. They were

---

6. Jäger: Ein histologisch untersuchter Fall von Keratitis parenchymatosa, Klin. Monatsbl. f. Augenh. **74**:488, 1925.

7. Reis: Beiträge zur Histopathologie der parenchymatösen Erkrankungen der Cornea, Arch. f. Ophth. **66**:201, 1907.

8. Stanculeano: Seltener Befund an der Hinterfläche der Cornea bei einer klinisch diagnostizierten Keratitis parenchymatosa, Klin. Monatsbl. f. Augenh. **42**:456, 1904.

9. Von Hippel: Ueber Keratitis parenchymatosa und Ulcus internum corneae, Arch. f. Ophth. **68**:354, 1908.

10. Kunze: Anatomische Untersuchung eines Falles von Keratitis parenchymatosa et lue hereditaria, Arch. f. Ophth. **102**:205, 1920.

11. Gilbert: Zur Klinik und Pathologie der angeborenen Augensyphilis, Arch. f. Augenh. **87**:59, 1920.

pronounced and extensive, in contrast to the usual observations in the histologically examined cases of interstitial keratitis previously reported.

For the sake of clearness, the following special points with reference to the microscopic observations are discussed separately under numerical headings:

1. The corneal changes shown in this case were unusual. They involved all the layers.

2. Bowman's membrane was not destroyed, but was irregular in thickness; in places it was so much eroded that it was reduced to a threadlike structure, still demonstrable by the van Giesen stain.

3. The lymphocytic nodules usually described in the cornea in such cases consisted, in this case, almost entirely of proliferated fixed corneal cells, which occurred in all the layers. Only a small number of lymphocytes were found along the newly formed blood vessels.

4. In spite of the fact that the pathologic process had been present for one year, retrogressive changes such as cicatrization were not noted in the cornea. Vascularization was present, but sclerosed vessels, indicating the beginning of cicatrization, were not visible; on the contrary, the blood vessels were wider than normal and were filled with blood, both clinically and anatomically.

5. An important and interesting point was the dense infiltration in Schlemm's canal with numerous lymphocytes, in contrast to the only slight or moderate infiltration in the cornea and the iris. From this fact, one may conclude that in the anterior part of the eye, Schlemm's canal and the region around it comprise the most densely infiltrated area. What is the explanation for this? It may be assumed that the toxins circulate in the posterior and anterior chambers, and, becoming concentrated in the region of Schlemm's canal, cause a sort of chemotactic infiltration there.

6. Previous authors, such as Kestenbaum,[12] Stähli,[13] and Lehmann,[14] observed "glass stripes" ("Glashautleisten") on the posterior surface of the cornea in the anterior chamber, clinically, in cases of healed interstitial keratitis. Just what this membrane is histologically is still in dispute. It may be possible that glass stripes having the same appearance clinically are produced by structures which are histologically different from one another. In the present case it was not possible clinically to

---

12. Kestenbaum: Sogenannte Glasleisten nach Keratitis parenchymatosa, Ztschr. f. Augenh., vol. 54, p. 113.

13. Stähli: Ueber persistente retrocorneale Glashautleisten in ehedem parenchymatosakranken Augen, Klin. Monatsbl. f. Augenh. **63**:336, 1919.

14. Lehmann: Beiträge zur Kenntnis der Glasleistenbildung an der Hornhauthinterfläche bei abgelaufener Keratitis parenchymatosa, Ztschr. f. Augenh. **62**:230, 1927.

determine whether there was a membrane in the anterior chamber, owing to the opacity of the cornea. Histologically, a connective tissue membrane was found in the anterior chamber which was apparently attached to the cornea before fixation. Clinically, this structure might possibly have given the appearance of glass membrane, on account of the regular parallel arrangement of its fibers like the corneal lamellae. Against this assumption, however, is the fact that it does not lie in the central part of the cornea and disappear toward the limbus, as is the case with glass membranes. Watanabe [3] also found histologically a connective tissue membrane in the anterior chamber on the posterior surface of the cornea, but he did not mention whether it was visible clinically. He was of the opinion that it is formed from the endothelium of the cornea. In this case, the membrane was present opposite that part of the cornea from which the endothelium has practically disappeared, which fact seems to support Watanabe's view with regard to its origin.

7. The lymphocytic nodules on the pars plana of the ciliary body between the latter and the vitreous body was probably the result of chemotactic action of toxins from the aqueous or vitreous body; but the latter was practically free from any changes.

8. The pronounced and extensive choroidal changes were interesting. They affected chiefly the outer layers. The lesion in many places extended through the lamina vitrea without any obvious break of continuity in the latter. The changes represented probably a combination of those caused by interstitial keratitis with those caused by choroiditis disseminata. Could these choroidal foci have been seen if examination of the fundus had been possible? The answer is that they would probably have been seen only in small numbers, because the majority were covered by unaltered pigment epithelium. In the present case, the anterior choroiditis was not present, as is so often the case clinically. The oldest choroidal lesions were in the posterior parts.

9. The changes in the retina also were pronounced, the most conspicuous being the retinitic foci connected directly with the lesion in the choroid. The rods and cones were practically gone. The two nuclear layers and the ganglion cell layer were atrophied. There was a great deal of perivascular infiltration with lymphocytes. Proliferation of the vascular endothelium, however, which is found so regularly in acquired syphilis, was absent.

It is hard to explain how the eye became blind, especially when the choriocapillaries were present. The only explanation is found in the destruction of the rods and cones by the toxins derived from the severe choroiditis.

10. Of particular interest in this patient (a boy, aged 14) was the presence of severe chorioretinal changes all around the disk. In an

examination of the fundus, these changes would probably have presented a picture of retino-choroiditis juxtapapillaris, which was first described in 1909 by Jensen,[15] and later reported by Blessig[16] and Verhoeff.[17] Jensen found, in four cases which he observed, a peculiar ophthalmoscopic picture characterized by a patch of chorioretinitis situated close to the margin of the optic disk. Functionally, it was manifested by a sector-shaped defect in the visual field, with the apex corresponding to the blind spot. The central vision is usually not much impaired. It is not clear just what is the anatomic substratum of Jensen's retino-choroiditis juxtapapillaris. Verhoeff examined histologically an eyeball made blind as a result of syphilis of the tonsil. He found "a granulomatous lesion centered near the margin of the disc which involved chiefly the inner layers of the retina and only secondarily the disc and choroid." He considered the term retino-choroiditis of Jensen to be descriptive of the pathologic condition.

11. The chronic inflammatory changes found in the arachnoid of the optic nerve were interesting but difficult to explain as to origin. There were three possible explanations: (*a*) They may have been a part of the changes taking place simultaneously higher up in the central nervous system; (*b*) they may have been a direct extension from the choroidal lesions, and (*c*) they have been a direct extension from the lesion in the more anterior portion of the eye through the cortex veins. Concerning this last possibility, I am not able to say much, because, unfortunately, the tissue in the angle between the optic nerve and the sclera was not saved; this also makes it impossible to say whether the ciliary nerve or the orbital tissues were involved or not.

12. It should be emphasized here that nowhere in the iris, ciliary body or retina were there any vascular changes, such as are usually found in acquired syphilis. Proliferation of the endothelial cells, which were everywhere normal in appearance, was not observed. The lumen of the blood vessels was not obliterated, except that in some there was blocking by the lymphocytes, such as occurs in the choroid and retina.

13. In this case, the sclera was affected by the entire disease process, as a result of the corneal and choroidal lesions.

14. The changes in the anterior (corneal) part of the eye were probably simultaneous with those in the posterior (uveal) part.

15. In spite of the pronounced pathologic changes, evidence of exudate between the retina and choroid or in the vitreous body was not found.

---

15. Jensen: Retinochoroiditis juxtapapillaris, Arch. f. Ophth. **69**:41, 1909.

16. Blessig: Ein Fall von "Retino-choroiditis juxtapapillaris (Edmund Jensen)" chorioretinitis parapapillaris, Arch. f. Ophth. **74**:284, 1910.

17. Verhoeff: A Case of Syphilitic Retinochoroiditis Juxtapapillaris, with Microscopic Examination, Tr. Am. Ophth. Soc. **14**:568, 1916.

DISKLIKE DEGENERATION OF THE MACULA

WITH MICROSCOPIC REPORT OF A TUMOR-LIKE MASS IN THE MACULAR REGION *

T. B. HOLLOWAY, M.D.
PHILADELPHIA
AND
F. H. VERHOEFF, M.D.
BOSTON

During recent years, lesions about the macular region, both slight and marked, have been attracting more attention, and while we are still far from arriving at any definite conclusions concerning them as a group, attempts have been made toward such classifications as our present clinical and pathologic knowledge would permit or suggest During the past few years Batten, Coppez and Danis, Feingold, Junius and Kuhnt and, still more recently, de Schweinitz, have all made notable contributions toward grouping certain of these conditions.

The present contribution concerns certain macular lesions developing in the later years of life, types that have been so well depicted by Junius and Kuhnt.

REPORT OF CASES

CASE 1.—M. L., a man, aged 77, admitted to the University Hospital on March 29, 1927, stated that he could read until December, 1926. He denied having had a venereal disease, but said he had always been a steady drinker. Examination of the blood revealed mild anemia. There was some general arteriosclerosis.

Right Eye: More or less lens dust and a few opacities were observed in the lower periphery of the lens. The disk showed a yellowish atrophy. Directly in the macular region was a discoid area, which was gray with a slightly yellowish tinge. It showed a slight fenestration with the duller red of the underlying fundus showing through. At the lower border were two small pigment dots, and at the upper border, four distinct linear pigment streaks. Surrounding this area, there was a zone of superficial choroidal disturbance, apparently from 5 to 10 mm. wide, and in this area, the choroidal vessels showed signs of sclerosis. Beyond the macula at the outer border of this zone, a dozen colloid dots were seen. Down and in beyond the zone and beneath the inferior temporal vessels, there was a disk-sized area of choroidal thinning, and a similar area just above the macula, beneath the superior temporal vessels.

---

* Submitted for publication, Oct. 29, 1928.

* Read before the American Ophthalmological Society, Washington, D. C., May 1, 1928.

* Owing to lack of space, the reports of cases have been condensed. A full report will be found in the Transactions of the American Ophthalmological Society, 1928, vol. 26.

The retinal vessels showed an excessive degree of angiosclerosis, but there were no fresh hemorrhages. Vision in this eye was 1/100.

Left Eye: At the posterior pole of the eye, there was a lesion somewhat similar to that noted in the right eye, but without a surrounding zone. Instead of appearing tacked down at the macula, this area was occupied by a brownish pigmented area studded with a few grayish-white dots. Several cholesterin dots were noted; otherwise, the intra-ocular condition was similar to that of the right eye. Vision in this eye was 1/100.

A change did not take place for a period of six months.

Case 2.—T. M., a man, aged 68, first seen at the University Hospital on Nov. 12, 1907, complained of dizziness. Examination at the medical dispensary revealed a chronic nephritis and arteriosclerosis.

Right Eye: There was a slight nuclear haze in the lens. The disk appeared to be healthy; the macula was somewhat granular. The retinal vessels were sclerosed. Vision in this eye was 6/22 (?).

Left Eye: Beginning at the upper margin of the disk and sweeping around the macular region, there was a typical whitish circinate lesion, and scattered about within it, a number of yellowish dots. The lens showed a slight nuclear haze, and the vessels were sclerosed, as in the right eye. Vision permitted counting of the fingers at 13 inches (32.53 cm.).

During the next few months, the lesions in the left eye tended to show a gradual but progressive change. The circinate patch became less distinct and more yellow, while the lower and outer edge became slightly pigmented. Within the circle, a vague exudate was observed, with slight pigmentation adjacent to it. A year later, changes were still occurring and numerous fresh hemorrhages were developing about and within the circinate lesion.

During the next two years, these changes continued, exudates disappearing and reforming, associated with occasional hemorrhages. A few cholesterin dots became evident. Ultimately, the right lens became so hazy that a satisfactory study of the fundus could not be made.

Case 3.—H. L., a woman, aged 75, was seen in the Eye Dispensary of the University Hospital on April 20, 1920, when she said that she thought her glasses required changing. Dr. Smith reported from the Medical Department that the patient had a hypertension, cardiac hypertrophy and arteriosclerosis. The Wassermann reaction was negative.

Right Eye: The disk was normal. Bordering it above and to the temporal side was a yellowish-white exudate about one disk diameter in width. From the lower part of this exudate, adjacent to the temporal border, a tongue of exudate of similar character swept around the lower portion of the macular region, and when down and out from this area, the extremity of the tongue tended to break up into more discrete punctate lesions. Beginning at the upper and outer margin of the exudate adjacent to the disk, a circinate patch swept around the macular region below the superior temporal vessels. The exudative arcs did not quite meet beyond the macula. Within this area there were a few small yellowish exudates and hemorrhages with pigment stippling. The retinal vessels were definitely sclerosed. Vision permitted counting of the fingers at 6 inches (15.24 cm.).

Left Eye: The macula was granular and showed fine pigmentation. Vision was 6/12 (?).

During the next year and a half, the upper portion of the circinate lesion almost disappeared, while the lower portion became much less evident.

CASE 4.—K. B., a woman, aged 76, first seen on March 16, 1922, said that the vision of the right eye became affected three years before, and was now practically useless. Dr. George Norris advised me that her blood pressure was systolic 195 and diastolic 105, and the pulse rate 100. The urine showed a trace of albumin, but no sugar or casts. The observations on the blood were negative, although the hemoglobin content was only 60 per cent.

Right Eye: There were a few peripheral striae in the lower portion of the lens and a few vitreous opacities. The disk was healthy. The retinal vessels showed an excessive degree of angiosclerosis. Adjacent to the temporal side of the disk and sweeping completely around the macular region, was a typical circinate patch, varying in width from one-third to one-half disk diameter. There were distinct retinal disturbances within this area, especially toward the outer portion, where a cluster of small hemorrhages could be noted. Vision was 1/150.

Left Eye: The whole macular area showed vague erosions and pigmentation, interspersed with numerous yellowish-white lesions, probably colloid. The picture represented the senile macular changes not infrequently seen. One small discrete hemorrhage was present. The lens, vitreous, disk and retinal vessels were otherwise similar to those in the right eye. Vision was 6/22.

But little change occurred until December, when partial absorption of the circinate patch was observed, and a beginning circinate lesion was evident in the left eye. One month later, the lesion in the left eye was more pronounced, and a few cholesterin crystals and fresh hemorrhages were evident in the right eye. By November, 1923, the whole lower portion of the circinate patch in the right eye had practically disappeared, and there was a complete typical circinate lesion in the left eye.

CASE 5.—H. W., a man, aged 79, was first seen at the University Hospital on Jan. 18, 1924, when he complained of poor vision, especially in the left eye. The urine showed a trace of albumin and an occasional cast. The blood urea nitrogen and blood sugar were normal; the Wassermann reaction was negative.

Right Eye: There were a few peripheral striae in the lens and a few vitreous opacities. In the macular region, there was a diffuse yellowish exudation with marginal punctate yellowish-white dots. A few small fresh hemorrhages were present. The retinal vessels were distinctly sclerotic.

Left Eye: The lens and vitreous were similar to those of the right eye. Beginning near the upper and outer border of the disk, a tongue of yellowish exudation swept around the macular region below the macula. The circinate effect was incomplete beyond the macula. Directly in the macular region, there was a greenish-yellow, moundlike exudate, over which small vessels could be seen to bend.

During the next two months, there was a progressive change in the lesions; those in the right eye became less pronounced, while the crescentic exudates in the left broke up into isolated areas. The central mass was becoming more circumscribed and spherical in outline. These changes continued up to the time the patient passed from observation several months later, when a few cholesterin dots could be seen in the left eye. The exudative lesions then had a slightly striated appearance at their outer portions. The macular mass had lost part of its greenish tint, and the vessels over it could be seen with an 8 diopter lens.

CASE 6.—J. R., a man, aged 68, first seen at the University Hospital on March 4, 1925, had noted hazy and cloudy distant vision nine months previously. This condition became worse during the next three months, but since that time

had remained about the same. Examination of the blood revealed mild anemia; the Wassermann reaction was negative. The phenolsulphonphthalein test revealed a total of 31 per cent in two hours. The urine showed a trace of albumin. There was a moderate arteriosclerosis.

Right Eye: The disk was surrounded by a narrow area of atrophy with irregular borders. About the macular region, there were several small irregular erosions, and between the macula and the disk, there was a thin disk-sized hemorrhage. The retinal vessels were sclerosed. Vision was 6/12.

Left Eye: The disk was similar to that in the right eye and surrounded by a similar zone, with a short spur extending upward and one downward. Beginning just off the disk below the superior temporal vessels, a hemorrhagic area swept outward and around the macular region, terminating at the lower and outer atrophic zone about the disk. It was circinate in form, incomplete only on the disk side; it varied from two-thirds to one disk diameter in width. The inner border was regular, the outer, irregular. Punctate yellowish lesions were present beyond the hemorrhage below the inferior temporal vein. Within the hemorrhagic oval there was a slightly elevated exudative lesion, yellowish, with a greenish tint. Vision permitted counting the fingers at 1 foot (30.48 cm.).

One week later, some absorption had occurred in the hemorrhagic area, and vague yellowish areas of exudate were appearing about the lower borders. One month later, a marked change was apparent. The area formerly occupied by hemorrhage was now replaced by a yellowish exudation, and the only trace of hemorrhage that remained was a narrow fringe along the outer border of the exudate beyond the macula. Small vessels could be traced over the central elevated mass which now extended almost to the outer portion of the circinate patch. During the next three months, the lesions slowly but constantly changed, with fresh hemorrhages developing in the macular region of the right eye. The central elevated area in the left eye tended to become more circumscribed. The final vision recorded was right eye 5/150 and left eye 3/150.

Right Eye: There were a number of peripheral striae in the lens and a few vitreous opacities. The disk was healthy. The retinal vessels exhibited an advanced stage of angiosclerosis. Throughout the macular region and about the superior and inferior temporal vessels near the disk, were numerous punctate tallow-like exudates, with a few punctuate hemorrhages. In the macular region, there was a disk-sized hemorrhagic area; in the upper and inner portion, the extravasation was dense. Beginning one disk diameter below the disk there was a comet-shaped hemorrhage that swept along the inferior temporal vessels, to pass under them and extend between the macular and the same vessels. The upper portion was vague, but the lesion became gradually denser until beneath the macular region it was quite dense, and had a slightly greenish tint.

Left Eye: Striae and punctate opacities were present in the lens; there were a few vitreous opacities. The disk and vessels were similar to those of the right eye. The macula was granular, and a few saturated yellowish dots were present, associated with a few fine pigment dots.

One month later, the vision of the right eye was 6/60. The whole macular region was dark and dusky and studded with a few light punctate dots. The comet-shaped hemorrhagic area was replaced by a deep yellowish exudation which was uniform in density and not mottled.

After another month, the vision of the right eye was still 6/60, but a decided change was observed in the fundus. Beginning at the margin of the disk there was a more or less sharply defined buff-colored exudate that swept around the upper and outer portion of the macular region. It was about one-half disk

diameter in width. Along the temporal border of the disk and spreading out beneath the inferior temporal vessels, was a yellowish exudate. From this patch, a typical circinate band swept below the macular region to join the band sweeping around it from above. The tract of exudate over the site of the comet-shaped hemorrhage had now taken on a stippled appearance, and formed a separate band external to and below the circinate band sweeping just below the macula. The whole macular region showed distinct retinal changes, was darker than normal and exhibited a few yellowish dots. About the outer limits of the macular region, just within the circinate area, there was a poorly defined arc made up of delicate punctate white dots. There were no fresh hemorrhages. The left eye remained unchanged.

When the patient was seen on March 26, 1928, small patches of solid brownish-black pigmentation were forming at the site of the circinate patch below the macula. A few fresh hemorrhages were present down and out from this area. The circinate markings over the distribution of the early comet-shaped hemorrhage were less distinct.

CASE 8.—J. V., a man, aged 63, first came to the Eye Dispensary of the University Hospital on Feb. 24, 1925, complaining of defective vision of the right eye. Vision permitted counting the fingers at 1 foot (30.48 cm.); vision in the left eye was 6/75. The fundus conditions were the same as those which will be described in connection with his admission to the ward.

He was admitted to the hospital on March 17, 1925, when he stated that the vision of the right eye had been poor for ten or fifteen years, but had failed perceptibly during the last fifteen months. For some time, what he knew to be a straight line had appeared to be wavy. The chest was normal; the Wassermann reaction was negative; the blood sugar was normal. As the result of his medical examination, a diagnosis was made of generalized arteriosclerosis with hypertension, moderate cardiac hypertrophy and chronic nephritis of the arteriosclerotic type.

At this time, the fundus of each eye showed the following conditions:

Right Eye: The disk appeared to be healthy, but was slightly hazed at the lower margin where the vessels cross. Beginning one and one-half disk diameters from the temporal margin of the disk, there was an old yellowish-white area lying at the margin of the larger mass which will be described. Directly in the macular region, there was a somewhat pear-shaped mass, grayish-white, with a faint greenish tint. The upper part of the mass faded off gradually into the upper macular region. It measured two and one-half disk diameters in width by three disk diameters in height. Along the lower and outer border there were several yellowish-white lesions, the size of a pinhead, possibly colloid. At the outer border, a larger, and more or less irregular, yellowish-white area was observed, directly opposite the first one described. From the surrounding vessels, tiny branches coursed over the sides of the mass, the apex of which could be seen with a 7 diopter lens. Vascular dilatations and hemorrhages were not noted. About the center of the tumor mass, there was a tiny grayish-dot surrounded by a lighter zone. Up and out from the macular region, in conjunction with the superior temporal vessels, there was a large retained patch of medullary sheaths, which was four by one and one-half disk diameters in size. The retinal vessels showed well defined angiosclerosis, and about the periphery of the fundus there were the vague changes not infrequently seen in association with such changes, and associated with probable colloid dots.

Left Eye: The disk, vessels and periphery of the eyegrounds were similar to those in the right eye. Directly in the macular region was a yellowish-white

mottled area, one-half disk diameter in size, and surrounding this and throughout the macular region, a number of yellowish-white dots were seen, mingled with diffuse and delicate punctate pigmentation, the whole picture being regarded as degenerative. Hemorrhages were not present.

During the next two years, only slight gradual changes occurred in the two eyes, the macular mass in the right eye remaining practically the same and the old yellowish areas laterally becoming less evident.

On Feb. 4, 1927, the patient came to the outpatient department and stated that he had been having some gastro-intestinal trouble and desired to be admitted to the hospital. It was then discovered that he had an intestinal obstruction, probably the result of old adhesions. He died the next day, following an abdominal operation. At this time, ocular observations were not recorded.

As the result of a voluntary promise made to me a year before his death, and the unsolicited instruction given by his wife to the hospital authorities immediately after the patient died, I obtained both eyes within an hour and a half following his death. These were forwarded to Dr. Verhoeff for pathologic examination.

EXAMINATION OF SPECIMENS OBTAINED IN CASE 8

Specimens submitted consisted of the right eye and the posterior half of the left eye, both in a 10 per cent solution of formaldehyde. They were placed for twenty-four hours in a 70 per cent solution of alcohol containing 2.5 per cent of hydrochloric acid; then the right eye was opened.

The right eye showed a moundlike elevation in the macular region, but otherwise appeared normal. The left eye did not show any pathologic changes so far as could be determined by the naked eye, but the retina was separated, evidently as a result of the manipulations necessary for the removal of the specimen.

Both specimens were embedded in celloidin, and a complete series of horizontal sections was made through the macular region of each eye. All the sections of the right eye were examined under the microscope, and most of them were stained in hematoxylin and eosin and mounted. A few sections were stained in Verhoeff's elastic tissue stain, van Gieson's stain and Mallory's phosphotungstic acid hematoxylin; serial cross sections were made of the central portion of each optic nerve.

Microscopic Examination of the Right Eye.—The moundlike elevation in the macula consisted chiefly of hyaline connective tissue situated between the retina and the choroid. This tissue was colored red by van Gieson's stain and did not show any definite elastic fibrils in sections stained by Verhoeff's method. In a median section, the mound measured 0.75 mm. in height and 3.5 mm. in diameter. The tissue was not firmly adherent to Bruch's membrane and in some of the sections showed artificial separation from it. The inner surface of the mound was sharply defined, showing only microscopic irregularities, but the retina was firmly united with it. The tissue consisted of coarse lamellae between which there were elongated spaces with cells often resembling corneal corpuscles. The lamellae in general were parallel to the inner surface of the mound. In most sections on each side, the tissue continued from the base of the mound as a thin diminishing layer for a distance of about 5 mm. under the retina. The mass was free from lime salts, cholesterin crystals and blood pigment. Stretching into the mass from the base, were strands of cells undoubtedly

derived from the pigment epithelium, containing coarse pigment granules. Some of the cells were irregular in shape; some were spindle shaped. Associated with these cells and often connected with them were recently proliferated cells, some of which were unpigmented. Beneath some of the strands near the base of the mass, there was a layer of colloid material which had evidently been separated from Bruch's membrane by the growth of connective tissue. The pigmented cells were most abundant at the base near the periphery. As the inner surface of the mass was approached, fewer and fewer of the cells were pigmented, so that in the anterior half practically all of them were free from pigment. A few of the nuclei here stained feebly or showed disintegration, and occasionally all that remained of a cell was a clump of pigment granules. Accompanying some of the strands were a few small blood vessels, usually with walls of endothelium only. With these vessels, there was sometimes a small amount of connective tissue which differed from that of the main mass in that it was more delicate, and not only stained less deeply in eosin but took the hematoxylin stain slightly. A few other blood vessels were found at the base near the lateral margins of the mass. Most of these also had walls of endothelium only, but an occasional small artery with a delicate internal elastic was seen, some of which showed intimal proliferation. Capillaries and even fairly large vessels were also sometimes seen in the connective tissue which extended beyond the margins of the main mass. After careful examination of many sections, a few vessels, accompanied by a small amount of connective tissue, were found extending from the choroid through small defects in Bruch's membrane. These were present only near the lateral margins of the mass, however, and never beneath the central portion. The inner half of the mass was almost devoid of blood vessels, but a few obliterated capillaries were seen here. Only one vessel was found entering it from the retina; this was about three times the size of a capillary, had only an endothelial wall and left the retina at a point 0.25 mm. from the fovea.

The retina over the mass was greatly altered, but chiefly in its outer layers. Over the central portion the neuro-epithelium, including the outer nuclear layer, was completely destroyed, but the inner nuclear layer and the ganglion cells were well preserved. Toward the periphery, the outer nuclear layer was partly preserved. In a few places, the outer limiting membrane was intact but curved so as to form with the remains of the rods and cones a half roset. The retina showed little neurogliar proliferation, but in places there was a slight amount of new formed neuroglia between the retina and the underlying connective tissue. The retina took on a normal appearance within a distance of about 0.75 mm. from the margin of the mass on each side. Directly at the margin, it was distorted, but none of its layers except the rods had been destroyed. Neither over the mass nor elsewhere did the retina show any edema, deposits of hyaline fibrin or pigmentation.

As the mass was approached from the sides, numerous colloid bodies and stretches of colloid material, such as commonly occur in senile eyes, were seen on Bruch's membrane. Then, a layer of delicate connective tissue appeared, usually beneath the epithelium or colloid material, but in places both above and beneath it. The pigment cells in this area were greatly altered and showed proliferative changes. Many of the cells had become spindle-shaped, were partly or wholly free from pigment, and seemed to be producing the connective tissue. In places, the altered pigmented epithelium was separated from Bruch's membrane by a layer of colloid material, while growing along the membrane were small unpigmented spindle cells which could be traced into continuity with the pigment epithelium laterally. With these cells was a slight amount of con-

nective tissue which they had apparently produced. When the main mass was reached, the pigment epithelium was seen extending into it in the form of irregular strands, while the connective tissue became continuous with that forming the mass. In some sections, however, there were stretches of connective tissue free from the blood vessels beyond the margin of the mass which were not connected with the latter. As already mentioned, blood vessels were sometimes seen in the connective tissue extending beyond the main mass.

At the margins of the mass, there were, in places, collections of swollen transparent cells filled with fine granules. These were certainly pigmented cells which had undergone fatty degeneration, for all transition stages in the process could be traced.

Bruch's membrane in the macular region was, in general, more conspicuous than elsewhere. It was thicker and was stained diffusely by both the hematoxylin and the eosin, so that its three layers could not be distinguished. As pointed out elsewhere,[1] three layers normally can be recognized in this membrane; an inner cuticular, a middle elastic and an outer connective tissue layer. Even in sections stained by Verhoeff's elastic tissue stain the elastic layer was not definitely recognizable. Here and there the membrane was wrinkled, evidently as a result of cicatricial contraction of the connective tissue mass, and in places behind the mass it stained so faintly that it could barely be seen. At the periphery of the mass, around the few small defects through which the vessels pass from the chroid, the membrane became ill defined and broke up into fragments before finally disappearing. Attached to the membrane behind the mass were a few colloid excrescences without epithelial covering.

The choroid behind the center of the mass was about one-half as thick as it was at the periphery of the latter. At places, it showed an insignificant infiltration with plasma cells and lymphocytes. Its stroma did not show any conspicuous alteration. The choriocapillaris at the periphery of the mass was normal in most sections. Directly behind the mass, the capillaries were almost entirely obliterated but, here and there, were still recognizable. In places, chromatophores were in contact with Bruch's membrane; in other places, there were from one to seven layers of spindle cells immediately beneath it. In some sections, similar changes were seen also for a considerable distance beyond the mass.

The choroidal arteries in the macular region, especially the small ones, showed marked endarteritis, often with complete obliteration of their lumina. Most of the large arteries were collapsed and showed proliferation of the intima with formation of new elastic tissue, and some of them showed marked hyaline degeneration. In the adventitia of some, deposits of lime salts were observed. The veins were distended with blood and showed slight, if any, endophlebitis.

Elsewhere than in the macular region, the eye showed only such changes as are commonly seen in senile eyes. "Warts" were observed on Descemet's membrane. The stroma of the ciliary processes was markedly hyaline, and its capillaries largely obliterated. The filtration angle was free. The iris and lens were normal. The choroidal veins were markedly distended, but their walls showed slight, if any, proliferative changes. The choroidal arteries showed marked endarteritis everywhere, but especially in the vicinity of the optic disk. The retina showed marked peripheral cystoid degeneration but otherwise was normal. Its vessels, including those in the macular region, showed only slight sclerosis, although the lumen of one fairly large artery at the periphery of the mass in the macula

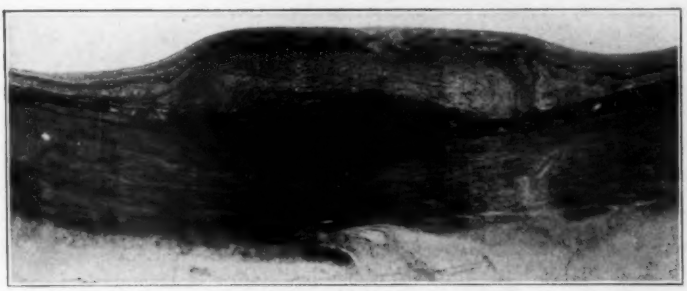
1. Verhoeff, F. H., and Sisson, R. J.: Basophilic Staining of Bruch's Membrane, Arch. Ophth. **55**:125 (March) 1926.

was almost completely obliterated. The pigment epithelium had formed numerous colloid excrescences. These were largest and most abundant at the equator. At the lower margin of the optic disk, it showed proliferative changes and had formed a layer of connective tissue on Bruch's membrane similar to that at the margin of the mass in the macula.

The optic disk and nerve were normal, showing not the slightest trace of atrophy. The central retinal vessels, examined in serial cross sections, were widely open and almost normal, behind the lamina cribrosa, but were partly collapsed and showed marked endovasculitis within the lamina. Here the wall of the vein was thickened and hyaline, and the lumen reduced to about one-fourth its normal diameter. The intima of the central artery was greatly thickened by proliferated spindle cells which greatly reduced the size of its lumen.

The posterior ciliary arteries seen in the orbital tissue remaining around the optic nerve showed moderate endarteritis. Occasionally, a small artery was found completely obstructed.

Microscopic Examination of the Left Eye.—The retina aside from the pigment epithelium was normal. Its vessels showed slight endovasculitis. The pigment



Microscopic section through the tumor mass (case 8).

epithelium showed marked degenerative changes with the formation of numerous colloid excrescences. Directly behind the fovea it was completely degenerated. Here, for a stretch of 0.7 mm., the cytoplasm and the nuclei had completely disappeared and a layer of colloid balls of various sizes was seen, over which there remained pigment granules, left by the pigment cells. There was not any formation of connective tissue on Bruch's membrane anywhere.

The choroidal vessels and the posterior ciliary arteries showed about the same degree of endarteritis in this eye as in the right. The vessels were not affected to a greater degree behind the macula, however, than elsewhere in the choroid. The choriocapillaris was normal throughout.

The optic disk showed slight but definite papilledema. The nerve stem was free from atrophy. The central retinal vessels showed slight endovasculitis, even within the lamina cribosa.

Comment.—That the mass beneath the macula consisted of connective tissue is certain, how it was produced is not so clear. The appearance at the base, especially at its periphery, seemed to indicate that it was produced by proliferating cells of the pigment epithelium. For here all the transition stages from normal pigment cells to pigmented spindle cells and finally into unpigmented cells undistinguishable from connective tissue cells could be made out. Moreover, these

cells showed the same intimate relation with the connective tissue as that displayed by the connective tissue cells elsewhere. That this mass was produced by the stroma cells of the choroid seems to be excluded by the facts that Bruch's membrane was intact behind the central part and that no vessels entered it here. Vascularization of the mass evidently occurred late, the vessels entering at the periphery, chiefly from the choroid, through small defects in Bruch's membrane. No doubt, a small amount of connective tissue was produced by the vessels or by the connective tissue cells which accompanied them. It would be necessary to assume that fibroblasts passed through the intact Bruch's membrane, if the choroid had produced the main mass. If this had occurred, it is reasonable to suppose that at the same time a considerable amount of new connective tissue would here have been formed within the choroid itself, but this was not the case.

There was nothing to indicate that the retina played any part in the formation of the mass. The older tissue was toward the retina, and only one vessel was found entering from the retina, a small vein near the fovea. This, however, was abnormally large for a vessel in that part of the retina. The fact that in places the external limiting membrane was intact showed that the tissue was produced beneath the retina. This would also seem to exclude the possibility that the tissue was due to organization of extravasated blood or fibrous exudate.

Why the pigment epithelium should produce connective tissue in this situation is not obvious. Senile pigmentary changes in the macula are of frequent occurrence, but the condition existing in this case is extremely rare. Whether the common senile macular changes are due to "Abiotrophy" as maintained by Collins, or to impaired nutrition, is a matter of conjecture. In the present case, colloid excrescences were unusually abundant in both eyes, but in the left eye they were not associated with any formation of connective tissue. Since remains of such excrescences could still be seen at the base of the connective tissue mass in the right eye, it is evident that preceding the formation of the mass the same condition of the pigment epithelium existed behind the macula of the right eye as existed in the left eye at the time of death. In both eyes, the choroidal vessels showed marked sclerosis, but in the left the choriocapillaris was normal and the retinal and central retinal vessels were only slightly sclerotic. In the right eye, the sclerosis of the choroidal vessels was especially marked in the macular region and the choriocapillaris was largely obliterated here. This obliteration, however, may have been due to compression, as the choroid was evidently compressed under the connective tissue mass. The retinal vessels generally did not show a higher degree of sclerosis in the right eye than in the left, but in the right eye the central retinal vessels showed marked endovasculitis, and one artery near the macula was completely obstructed. Obliterated capillaries around the macula were not seen, but they may have been overlooked. It would seem probable, therefore, that impaired nutrition was an essential factor in causing the hyperplasia and metaplasis of the pigment epithelium leading to the formation of connective tissue behind the macula in the right eye.

The histologic picture in this case was essentially the same as that depicted by Michel, Axenfeld, Elschnig and Knapp in their cases. In discussing Knapp's case before the American Ophthalmological Society in 1919, I expressed the opinion that the new tissue was produced by the pigment epithelium. Axenfeld stated that in his case the impression was given that the proliferated pigment epithelium played an essential part in the formation of the mass, but he concluded that his case belonged to the group described by Coats. In Axenfeld's case there was an area of ossification in the mass. This may have been produced by connective tissue cells which at a late stage had entered the mass from the

choroid. I have seen ossification of a large colloid excrescence produced in this way. However, since it is known that epithelium can produce cartilage, it does not seem impossible that the pigment epithelium could produce bone.

In many clinical cases reported in the literature there have been, in addition to the mass in the macula, hemorrhages and exudate more or less characteristic of retinitis circinata, suggesting a relationship of these two conditions. In the present case, however, the retina was entirely free from exudate or hemorrhage. This goes to show that the condition here described and retinitis circinata are related only in the sense that both are dependent on vascular changes and, therefore, not infrequently occur together.

SUMMARY OF CASES

The lesions in case 1, at the time of observation, were apparently and practically quiet, although there is no doubt in my mind that what it is convenient to call an exudate had been present, at least in the right eye.

Six of the patients had circinate lesions, all unilateral but one. In two instances, these lesions disappeared: in the one patient (case 2), they reappeared; in the other (case 4), they disappeared in the right eye, but the left eye developed a complete circinate patch while the patient was under observation. In two instances (cases 6 and 7), deep dense hemorrhagic circinate areas preceded the characteristic appearances. In one instance (case 6) short spurs radiated from the margins of the disk, which areas were attributed to the probable presence of thrombotic processes affecting the finer vessels adjacent to the disk.

In cases 5 and 6, definite tumor-like masses developed within the circinate area. In one patient (case 8) a well defined circumscribed tumor existed in one eye, but there were not any circinate or hemorrhagic manifestations associated with it.

In view of the fact that the literature pertaining to cases included in the group now under discussion has been but recently thoroughly reviewed by Feingold and Junius and Kuhnt, this will not be referred to in detail. Feingold and Coppez and Danis described their cases under the title of senile exudative macular retinitis. The last named observers gave detailed reports of their cases and were of the belief that the condition begins with a central scotoma, which, in the absence of definite macular evidence, might be mistaken for a retrobulbar neuritis. Later, whitish-yellow spots appear and metamorphopsia may be present. The spots ultimately fuse to form the plaques characteristic of the condition. They pointed out that the patients are of advanced years and have arteriosclerosis, but this is not excessive; occasionally, there is hypertension, and slight albuminuria may be present. Syphilis is not a factor. The general condition of the patient may be regarded as satisfactory. They looked on the disease as a morbid entity, distinct from Coat's disease, and pointed out the clinical differences between the two conditions. Feingold, on the other hand, stated that cases of this type have in

common with Haab's senile macular changes, the site at which they occur and the age at which they develop, but that was all. The fundus picture and the known histologic conditions differed. Pure degeneration and absorption of retinal pigment in the first group were contrasted with hemorrhages and degeneration that led to the formation of tumors, changes characteristic of the other group.

De Schweinitz, in discussing senile macular changes, divided them into four groups, including these so-called exudative cases in his fourth group. In speaking of the ordinary senile macular changes, he quoted Behr as advancing the suggestion that these may represent a special type of hereditary degeneration, the result of a congenital predisposition to premature death of the macular retinal neurons. This, in turn, brings one in line with Collins' suggestion of an abiotrophy which has been referred to by Verhoeff in his report.

We believe that Junius and Kuhnt were justified in including in this group those patients who exhibit circinate lesions. The patients exhibiting such changes present the same general medical conditions, and in certain instances, if the circinate lesions were absent, an ophthalmoscopic examination could not differentiate them. Whether they begin consistently with a central scotoma cannot be definitely stated, for I doubt whether opportunities for such studies have been offered or taken advantage of in a group of these cases. Further, when it is known that these circinate patches tend to undergo a slow but progressive change and, in certain instances, to disappear, it does not seem irrational to suggest that in certain instances when patients with these macular plaques come under observation, circinate lesions may have been present previously, or may develop later on in the progress of the case. Still further, it is interesting to note that several of the patients whose histories are now presented exhibited, in the eye without a circinate lesion, the ordinary senile macular changes.

Junius and Kuhnt summed up their opinions by saying that in addition to progressive tissue formation of various kinds common to the two conditions, circinate retinitis and disciform disease of the central retina show degenerative changes, the result of vascular disease. These changes sooner or later reach their limit and remain confined to the central retinal region between the vascular arches.

Additional comments are unnecessary concerning case 8 and its pathologic report. Few of these cases have been studied pathologically, and these are included in the series of Junius and Kuhnt, with the exception of Knapp's case, which they might have included, had it not, probably, been overlooked. The growth in our case appeared as a well organized circumscribed mass that might well have been regarded as a sarcoma; in fact, as was discovered later, such a diagnosis had been made prior to the examination of the patient by one of us.

THE REGENERATION OF THE AQUEOUS HUMOR*

PETER CLEMENS KRONFELD, M.D.
VIENNA, AUSTRIA

The regeneration of the aqueous humor has been the subject of many heated discussions during the past few years; these followed Hagen's [1] first article in 1920, but the subject had been studied for many years previously. In table 1, I have endeavored to point out the theories of most of the investigators who have dealt with this problem. A

TABLE 1.—*Theories of Investigators Regarding the Regenerated Aqueous Humor*

Author	Year	Animal Eyes	Human Eyes
Deutschmann	1879	Fluid from the vitreous body	(On account of its protein content)
Ehrlich	1882	Secretion of the ciliary body	
Schick	1885	Secretion of the iris	
Leplat	1887	Fluid from the vitreous body	
Greeff	1894	Secretion of the ciliary body	Secretion of the ciliary body
Bauer	1896	Secretion of the ciliary body	
Hamburger	1910	Secretion of the ciliary body	Secretion of the ciliary body
Hagen	1920	Secretion of the ciliary body; early starting and quickly passing	Secretion of the ciliary body, beginning late, lasting long, first regenerated fluid afforded by the vitreous body
Elschnig	1920	Transudate of the ciliary body	Secretion of the ciliary body
Loewenstein	1920	Secretion of the ciliary body	Entirely different from the secretions of the ciliary body, probably vitreous fluid
Roemer	1920	Secretion of the ciliary body	Secretory function of ciliary body very doubtful
Seidel	1920	Hematogenous filtrate, passing through the ciliary body through a membrane with wide pores	Hematogenous filtrate, passing through the ciliary body through a membrane with small pores
Wessely	1920–1924	Only quantitative differences due to different degrees of the vasomotor reaction which follows the puncture	
Magitot and Mestrezat	1922	Filtration force	
Dieter	1925	Dialysate	Dialysate
Baurmann	1926	Ultrafiltrate from the venous part of the capillary system	
Duke-Elder	1927	Dialysate	Dialysate

casual glance at this table will show that the mode of formation, as well as the source, of the second specimen of aqueous humor is controversial. All the possibilities of formation of a fluid through living and nonliving membranes, such as filtration, transudation, exudation, secretion, dialyzation and ultrafiltration were taken into consideration. The blood and the vitreous body were thought to be the sources of the second specimen of aqueous humor. The last three years have brought about a certain amount of agreement on this subject. The opinion of

* Submitted for publication, Dec. 8, 1928.

* From the Eye Clinic of the University of Chicago.

* Presented before the American Ophthalmological Society, Washington, D. C., May 7, 1928.

1. Hagen, S.: Klin. Monatsbl. f. Augenh. **64**:187, 1920; **65**:643, 1920; **66**:493, 1921; **67**:259, 1921.

Wessely,[2] Gilbert,[3] Dieter [4] and Baurmann [5] has remained unopposed during this time.

The reformation of aqueous humor has been studied by anatomic, chemical and physical methods. To what extent the structures of the tissues of the eyes of human beings and animals are changed by a puncture of the anterior chamber has been described carefully and completely, so that I have nothing to add to the histologic data.

The physical changes of the eyeball or the behavior of the intraocular tension following the puncture of the anterior chamber have been investigated by several others as well as by myself. I shall report my conclusions on this part of the problem in another paper in connection with certain observations that I have made on glaucomatous eyes.

The present report deals with the chemistry of the second specimen of aqueous humor. Many statements have been made about the protein content of this fluid since its discovery. The amount of protein in the regenerated fluid in the eyes of rabbits, dogs and cats was found to vary from 0.1 to 5 per cent. The methods employed in these investigations were often inaccurate. The second specimen of aqueous humor often contains almost the same amount of protein as the blood plasma. This fact has been the subject of several different interpretations, due to the point of view of the investigators. Hamburger [6] noted that the secretion of the ciliary body furnishes a product of a high protein content. The Frenchmen, Magitot and Mestrezat,[7] spoke of "filtration forcée" which forces the protein through the pores of the lining membrane between the blood current and the cavities of the eye. Wessely, Dieter, Duke-Elder [8] and others, who believe that the formation of the normal specimen of aqueous humor follows the rules of dialysis, explain the appearance of protein in the second specimen of aqueous humor by a change in the lining membrane itself, which, semipermeable under normal conditions, loses its tightness and becomes almost completely permeable as a result of capillary dilatation.

One must agree that the changed permeability of the lining membrane is the most important feature differentiating the second specimen from the first specimen of aqueous humor in the eyes of animals. Whether this physiochemical factor will enable one to understand all the phenomena observed at the refilling of the anterior chamber after a paracentesis, cannot as yet be decided. At any rate, I must confess

2. Wessely, K.: Arch. f. Augenh. **88**:217, 1921; **93**:184, 1923.
3. Gilbert, W.: Arch. f. Augenh. **88**:210, 1921; **94**:101, 1924.
4. Dieter, W.: Arch. f. Augenh. **96**:8 and 179, 1925.
5. Baurmann, M.: Arch. f. Ophth. **116**:96, 1925.
6. Hamburger, C.: Klin. Monatsbl. f. Augenh. **48**:47, 1910.
7. Magitot, A., and Mestrezat, W.: Bull. Soc. de Chem. Biol. **4**:279, 1922.
8. Duke-Elder, W.: The Nature of Intraocular Fluids, Brit. J. Ophth. Monograph Supplement 3, 1927.

that my working hypothesis is to refer to secretion only when the simple physicochemical model of a semipermeable membrane between the blood current and the aqueous humor will not fully explain the facts. I do not stand alone in the use of this hypothesis, as most ophthalmologists in English, French and German speaking countries are following this line of thought.

Subjects for careful examination have been the chloride and the sugar content. I have determined the bicarbonate or the carbon dioxide content of the first and second specimens of aqueous humor. The method I employed has been described in my first paper [9] on the gas content of aqueous humor. The fluid was obtained from the eyes of animals under either general anesthesia (ether) or morphine combined with local application of holocaine. The withdrawal of the aqueous humor from the eyes of human beings was always done with the subject under holocaine anesthesia. The fluid was drawn through a fine needle with a short beveled point. The needle was attached to a small syringe containing paraffin oil, in order to prevent any loss of gas. The determination itself was made with the new portable model of van Slyke's [10] apparatus. It is important to use the fluid as soon as possible for the purpose for which it was withdrawn, because of the glycolysis which starts about twenty minutes after the withdrawal of the fluid. Glycolysis is the splitting of sugar into lactic acid, which process takes place in all organs and biologic fluids. The resultant lactic acid reduces the amount of sodium bicarbonate and changes the results to a remarkable degree. Therefore, the determinations of the carbon dioxide content in blood, spinal fluid or aqueous humor should be made within the first thirty minutes following the puncture.

RELATIONSHIP BETWEEN BLOOD AND AQUEOUS HUMOR

The results of numerous investigations on the sugar content of the first and second specimens of aqueous humor which were published by van Creveld,[11] Ask [12] and Duke-Elder,[13] are not reliable because of the enormous lability of blood sugar in rabbits, dogs and cats. This is the reason that Duke-Elder is inclined to explain most of the differences in the sugar content of the first and second specimens of aqueous humor by the interference with a change in blood sugar. I must therefore confine myself to comparing my figures of the carbon dioxide content with the results for the chloride content given in the literature. Before I begin this comparison, I shall discuss briefly the relationship

9. Kronfeld, P. C.: Arch. f. Ophth. **118**:606, 1927.
10. Van Slyke, D. D.: Biol. Chem. **73**:695, 1927.
11. Van Creveld, S., and de Haan, F.: Biochem, Ztschr. **123**:190, 1921.
12. Ask, F.: Biochem. Ztschr. **59**:1, 1914.
13. Duke-Elder (footnote 8, p. 35).

between the first specimen of aqueous humor and the blood as far as the chloride and the bicarbonate ions are concerned. Both are known to be present in higher concentration in the aqueous humor than in the blood. To explain this fact the following points have to be taken into consideration:

1. The exchange of water and dissolved agents between the blood and the intra-ocular fluids takes place in the capillary system, where one is able to distinguish an arterial and a venous part. Passing from the former to the latter, the blood undergoes certain changes of the chloride and bicarbonate content. The chloride content decreases by about 5 per cent, while the bicarbonate content increases by from 6 to 8 per cent.

2. Because of the great difference in the protein content of blood and aqueous humor, the two fluids contain different quantities of water. One hundred grams of blood, for instance, contains about 93 Gm. of water, while in 100 Gm. of aqueous humor, almost 100 Gm. of water is found. Therefore, if equal weights of blood and aqueous humor are compared, the figures for the blood must be corrected by multiplying them by 1.10 (Baurmann [5]). If equal volumes of both fluids are compared, the concentration of water on both sides is almost the same (see point 4).

3. The possibility of a Donnan equilibrium (Meesmann,[14] Duke-Elder) has to be taken into account. The greatest difference which can be explained by Donnan's law is less than 1 per cent for sodium chloride; therefore, it does not play an important rôle.

4. It must be realized that even an exact determination of the chloride content of the blood does not give full information about the real concentration of this constituent in the blood stream. Blood is not homogeneous. It is not known to what extent water and all the other agents are bound by the blood colloids. It is evident now that almost all the constituents undergo an absorption on the part of the proteins of the blood. This absorption can be positive, which means that in the surface of the colloid phase, the agent is found in a higher concentration than in the water phase. In the case of negative absorption, the water phase contains more of the agent than the surface of the colloid. That even the bicarbonate content of blood is concerned by absorption has been proved by Warburg,[15] who found that the carbon dioxide content in 100 cc. of serum of a certain kind of blood was 67.6 per cent by volume, that the water phase of this serum contained 71.3 per cent by volume and the protein phase, 25 per cent by volume. These figures will be important for the explanation of the composition of the

14. Meesmann, A., and Lehmann, S.: Pflüger's Arch. f. d. ges. Physiol. **205**: 210, 1924.

15. Warburg, E. J.: Biochem. J. **16**:153, 1922.

second specimen of aqueous humor. They are not claimed to be exact, as it is difficult to analyze this protein phase without changing and disturbing the genuine conditions. This is true for the process of ultrafiltration as well as for all the other methods employed for the removal of the colloids. The dialyzation seems to be the mildest procedure, especially in the form of the "Kompensations-Dialyse" of Michaelis and Rona. Experiments on the dialyzation of plasma and

TABLE 2.—*The Carbon Dioxide Content of the Aqueous Humor of the Eyes of Human Beings*

Patient	Per Cent by Volume Carbon Dioxide: First Specimen	Per Cent by Volume Carbon Dioxide: Second Specimen	Difference in First and Second Specimen Given in Percentage of First	Interval
C. P., man, aged 45, tabetic atrophy of optic nerves				
VR 0.05				
VL 0.06				
3/30/28.....RE	68.80	75.0	9	30 minutes
4/10/28.....LE	65.95	72.50	10	25 minutes
E. L., man, aged 48, tabetic atrophy of optic nerves				
VR 0.3				
VL 0.05				
3/28/28.....LE	65.2	74.0	14	25 minutes
O. K., man, aged 50, tabetic atrophy of optic nerves				
VR 1.0				
VL 0.2				
4/15/28.....LE	68.5	76.1	11	20 minutes

TABLE 3.—*The Chloride Content of the Aqueous Humor of Human Beings*

Author	Mg. of Sodium Chloride in 100 Cc.: First Specimen	Mg. of Sodium Chloride in 100 Cc.: Second Specimen	Difference Between First and Second Specimens Given in Percentage of First	Interval
Meesman.....	0.716	0.704	1.75	30 minutes
Gala.....average	0.7–0.78	0.68–0.72	1–3	45 minutes
Ascher.....	0.764	0.759	0.75	1 hour

normal physiologic sodium chloride under a carbon dioxide pressure of 40 mm. always show higher carbon dioxide concentration in the "Aussenfluessigkeit" than in the plasma. Exact figures were given by Rona and Gyoergy.[16] I have repeated these experiments several times.

These four points show the intimate and complicated relations between the blood and the aqueous humor. They also throw some light on the relation between the first and second specimens of aqueous humor.

Discussing first my observations on the eyes of human beings, I must conclude from the results given in table 2 that the second specimen of fluid, withdrawn from twenty to thirty minutes after the first puncture, shows about 8 or 10 per cent more bicarbonate, and, as table 3

16. Rona, P., and György: Biochem. Ztschr. **56**:416, 1913.

shows, from 1 to 3 per cent less chloride than the first specimen of aqueous humor. I have already stated that the venous blood contains less chloride and more bicarbonate than the arterial. Following a suggestion of Baurmann and approving it by exact figures one may say that the second specimen of aqueous humor in the eyes of human beings resembles the venous, and that the first specimen resembles the arterial blood. The second specimen seems therefore to be as hematogenous as the first, only the source, the blood, has changed owing to the vasomotor processes following the puncture of the anterior chamber. The anatomic studies of many investigators have shown this venous hyperemia. It was mentioned recently by Gilbert [17] and Rados.[18] Before one can be sure that the second specimen of aqueous humor is more or less hematogenous, however, Hagen's theory must be considered. He believes that "the first specimen of regenerated fluid in the eyes of a human being is derived from the vitreous body. About thirty minutes later, the secretory function of the ciliary body starts and furnishes a product of a low protein content, while the primary regenerated fluid is found to be entirely free from protein." His two main arguments for the derivation of the first specimen of regenerated fluid from the vitreous body are: 1. By tonometry the tension of the eyeball was still zero when the anterior chamber had already obtained its normal depth. Hagen interpreted this fact as a proof of the derivation of the newly formed fluid from the vitreous body, as its origin from the blood would have caused an increase in the tension. 2. The protein content of both fluids should be identical because the refractometer readings of the first and second specimens of aqueous humor were the same.

I shall discuss the first point in my next paper. I believe that most investigators feel that the intra-ocular tension, if observed with a manometer, often drops below zero after withdrawal of aqueous humor. The tonometer, however, cannot register pressure lower than zero. Therefore a slow inflow from the blood into the eye, causing a rise in the tension from a minus value up to zero, cannot be detected by the tonometer. The second argument of Hagen has been checked by Wessely, Magitot and Mestrezat, Gilbert, Gala [19] and Dieter, with the conformable result that even the first specimen of regenerated fluid in the eyes of human beings shows a slightly increased protein content. The appearance of protein in the second specimen of aqueous humor of the eye of a human being does not reach the amount found in the eye of an animal. At any rate, the results can be compared with those of all the other beings. Some of the retests were made on eyes of

17. Gilbert, W.: Arch. f. Augenh. **88**:210, 1921.
18. Rados, A.: Arch. f. Ophth. **109**:342, 1922.
19. Gala, A.: Bratisl. lekárs. listy. **3**:192, 1924.

human beings within from ten to twenty minutes after the paracentesis, so that the primary specimen of regenerated fluid was the subject of examination. Even those showed the increased protein content.

If the regenerated fluid was derived from the vitreous body, it should have the same composition as the latter. Therefore the next question is, how much carbon dioxide is found in the vitreous fluid? The chemistry of this fluid has been studied carefully several times. Recent investigations on the eyes of dead horses, oxen and pigs were made by Cohen, Killian and Metzger.[20] These authors found slight but constant differences between the composition of the aqueous and the vitreous humor as far as the chloride and the sugar content were concerned. The carbon dioxide content of both fluids was found to be practically the same. It must be realized that these investigations on the eyes of dead animals cannot reach the exactness of an analysis carried out in vivo. Why Ask [21] found in rabbits from 30 to 40 per cent

TABLE 4.—*The Carbon Dioxide Content of the Vitreous Fluid*

	Subject No.	Aqueous Humor of Right Eye per Cent	Aqueous Humor of Left Eye per Cent
(A) Dogs 20 minutes under ether; left eye posterior sclerotomy with Graefe's knife in situ; aspiration of vitreous fluid from the center of the eyeball	(1)	64.0	62.1
	(2)	71.3	68.4
	(3)	68.8	66.0
(B) Dogs 20 minutes under ether; enucleation of left eye; the eye was opened about 10 minutes later by an equatorial incision; the vitreous humor was run under liquid petrolatum	(1)	65.2	60.0
	(2)	62.8	55.1
	(3)	61.4	54.8

less sugar in the vitreous fluid than in the aqueous humor is bound to be the subject of a further discussion. Ask must prove first that the blood sugar did not change to a great extent during his experiments.

I have carried out some determinations on the carbon dioxide content of fluid from dogs' eyes in vivo. The only exact way is to puncture the anterior chamber of one eye and withdraw vitreous fluid from the other eye at the same time. This has not been done in any of the experiments the results of which have been reported. My results, as given in table 4, show that the aqueous humor withdrawn with a strong needle from the center of the vitreous cavity contains a little less carbon dioxide than does the aqueous humor of the other eye. Several times I enucleated one eye, opened it immediately afterward and let the vitreous humor run under a layer of paraffin oil, from whence it was introduced into the van Slyke apparatus. Following this method, I always obtained less carbon dioxide than in the aqueous humor

20. Cohen, M.; Killian, F., and Metzger: Contributions to Ophthalmological Science, Jackson Birthday Book, 1926, p. 216; Arch. Ophth. **57**:59, 1928.

21. Ask, F.: Acta Ophth. **5**:23, 1927.

of the other eye. I believe that the stoppage of retinal circulation produces rapid chemical changes in the retina as first suggested by Warburg [22] and his co-workers. The result is an inflow of lactic acid into the vitreous humor, which reduces the amount of sodium bicarbonate.

I have not had an opportunity to examine the vitreous fluid of a normal human eye. A determination of the carbon dioxide content of this fluid, however, could not prove anything without an examination of the aqueous humor of the other eye. From the results obtained on the eyes of dogs one may assume with a high degree of probability that a similar composition exists in the vitreous fluid of human beings. The vitreous body cannot play an important rôle in the regeneration of the aqueous humor in the eyes of a normal person.

I shall now consider the conditions in the eyes of animals. A casual glance at tables 5 and 6 shows that the chloride content as well as the bicarbonate content is markedly lower in the second than in the first specimen of aqueous humor. The difference in the chloride content amounts to from 6 to 8 per cent; the difference in the bicarbonate content amounts to 40 per cent of the values for the first specimen. The conditions seem to be much more complicated than in the eyes of man, apparently due to the highly increased protein content of the second specimen of aqueous humor in the eyes of animals. Point 1 (see page 234) can explain the composition of the regenerated fluid to a certain extent, the low carbon dioxide content speaking for its being derived from a more arterial plasma. All the other phenomena which accompany the regeneration of aqueous humor in these eyes denote a marked arterial hyperemia. I believe that the problem can be solved if point 4 is remembered. As I have shown in my first paper dealing with the carbon dioxide content of the first specimen of aqueous humor, the latter exceeds the carbon dioxide content of the blood most in rabbits, less in cats and much less in dogs. I again found the same relation as far as the difference between the first and second specimens of aqueous humor was concerned. In other words, the carbon dioxide content of the second specimen always resembles that of the blood, no matter how much that of the first specimen has differed from it. I believe that point 4, or variations in the carbon dioxide content of the water phase of the blood of those species, is the real reason for the great difference in the anion content of the first and second specimens of aqueous humor. Point 2 plays an important rôle in the determinations of chloride which were carried out on equal weights of aqueous humor and plasma.

As far as I see, the assumption of an exchange of water and all the dissolved agents of blood through a nonliving membrane, the perme-

22. Warburg, O.: Der Stoffwechsel der Tumoren, Berlin, 1925.

ability of which has been changed, is sufficient to account fully for the chemistry of the regeneration of aqueous humor. Even Seidel,[23] the champion of the theory of secretion, admits that the second specimen of aqueous humor is due to a simple filtration. I should like to demon-

TABLE 5.—*The Chloride Content of the Aqueous Humor in Animals*

Author	Subject No.	Mg. of Sodium Chloride in 100 Cc. First Specimen	Mg. of Sodium Chloride in 100 Cc. Second Specimen	Difference Between First and Second Specimens Given in Percentage of First	Interval
		Rabbit			
Van Creveld	(1)	649.4	623.0	4	8–10 minutes
	(2)	631.9	611.6	3	
	(3)	665.0	656.0	1.5	
	(4)	587.2	549.9	7	
	(5)	660.3	646.7	2	
Ascher	(1)	630.0	608.0	4	30 minutes
Meesman	(1)	630.0	580.0	8	
Gala	(1)	620.0	580.0	6	45 minutes
	(2)	620.0	580.0	6	
	(3)	640.0	620.0	3	
	(4)	640.0	620.0	3	
Ascher	(1)	650.0	666	2.6	1 hour
		Dog			
Meesman		720.0	690.0	4	?
Gala		780.0	730.0	6.5	45 minutes
Magitot and Mestrezat		777.0	720.0	7	40 minutes
		Cat			
Gala	(1)	760.0	730.0	4	45 minutes
	(2)	780.0	720.0	8	

TABLE 6.—*The Carbon Dioxide Content of the Aqueous Humor in Animals*

Animal	Subject No.	Carbon Dioxide per Cent by Volume First Specimen	Second Specimen	Third Specimen	Difference Between First and Second Specimens Given in Percentage of First	Interval
Rabbit						
Holocaine anesthesia	(1)	61.78	36.98	—	40	12 minutes
Holocaine anesthesia	(2)	62.06	41.3	38.7	33	7.14 minutes
Holocaine anesthesia	(3)	92.40	61.50	..	33	10 minutes
Dog						
Ether for 20 minutes	(1)	57.0	39.3	—	13	15 minutes
Ether for 20 minutes	(2)	60.78	54.4	—	10	15 minutes
Ether for 20 minutes	(3)	60.20	53.0	—	11	15 minutes
Ether for 1 hour	(4)	69.0	54.0	—	22	10 minutes
Cat						
Holocaine anesthesia	(1)	61.08	49.62	—	18	10 minutes
Holocaine anesthesia	(2)	68.76	55.00	—	20	10 minutes

strate convincingly that the composition of the second specimen of aqueous humor entirely depends on the blood from which it is derived, and is not due to a vital function of the cells of the ciliary epithelium. I think that the following experiment almost proves my opinion. I tied off one jugular vein in a dog, and a few days later withdrew the first

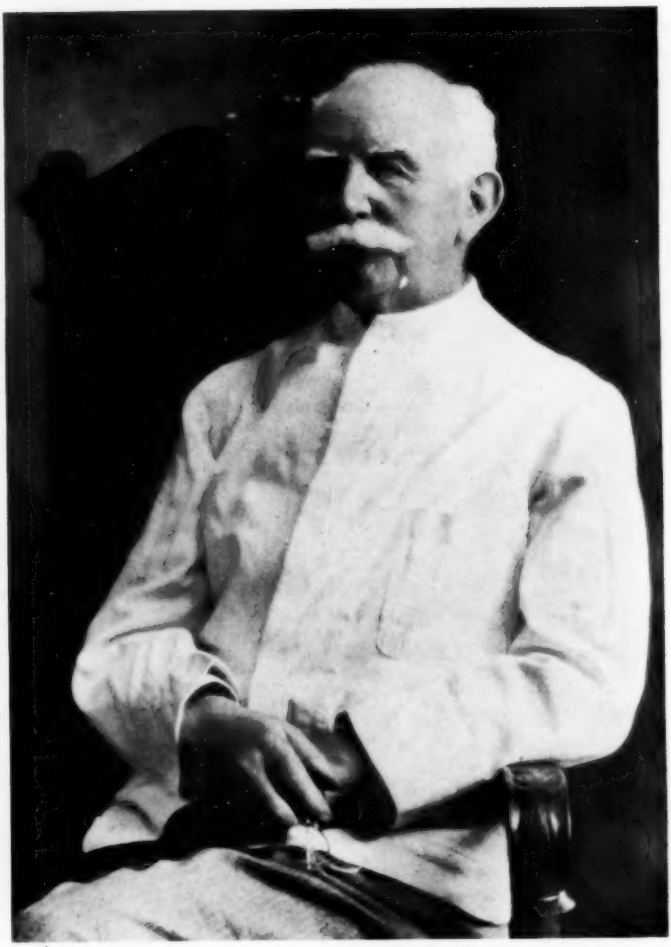
23. Seidel, O.: Arch. f. Ophth. **114**:162, 1924.

and second specimens of aqueous humor of the eye on the other side, while I compressed the second jugular vein just above the clavicle. Consequently, the eye was in a condition of marked venous stasis. The determination of the carbon dioxide of both of the fluids showed that the second specimen contained more bicarbonate than the first. In this case, the aqueous humor was derived from a venous blood plasma as it usually occurs in the eyes of man. It can be understood that if venous stasis occurs with capillary dilatation, the venous blood flows back to the capillary system from which the aqueous humor was derived.

SUMMARY

My idea of the mode of regeneration of aqueous humor, therefore, is that it is a physiochemical process which probably completely corresponds neither to dialyzation nor to filtration. The only vital component is the reactive capillary dilatation which, as Wessely has set forth, depends on the relation between the volume of the eyeball and the volume of the anterior chamber. This capillary dilatation is combined with dilatation of the fine arteries in the eyes of animals so that a large stream of arterial blood is carried into the capillary system of the eye. The arteries do not dilate enough to fill the capillary system in the eyes of human beings, so that the latter is mostly filled by venous blood. In my opinion, the chemical examinations given in this paper prove that under normal conditions the vitreous humor does not play an important rôle in the refilling of the anterior chamber. For all the anomalous conditions mentioned by Hagen, his theory might hold true.

I think that I have shown in this report that the study of the carbon dioxide content of the ocular fluids, combined with all the other methods used, gives new and valuable information on the regeneration of the aqueous humor.



LUCIEN HOWE, M.D.

1848-1928

Obituary

LUCIEN HOWE, M.D.
1848-1928

Dr. Lucien Howe died at his home in Belmont, Mass., on Dec. 27, 1928, in his eighty-first year. Thus passed a figure prominent in American ophthalmology and well known to his colleagues, both in this country and in Europe.

Lucien Howe was born in the little town of Standish, Me., on Sept. 18, 1848, coming of good New England stock. His father was a cavalry officer in the United States Army, stationed in New Mexico; thus, the son's earliest memories were of Santa Fé and Albuquerque, and there he learned to ride and to speak the Spanish language. He graduated from Bowdoin in 1870, of which college he was ever afterward a loyal son. He studied medicine at Harvard and Bellevue, and later in various European clinics, at one of which he had the privilege of sitting under Helmholz. On his return to America, he settled in Buffalo, where he practiced ophthalmology for fifty years. In 1876, he founded the Buffalo Eye and Ear Infirmary, and he served as professor of ophthalmology in the University of Buffalo. Even in his early years, he began his campaign for the control of ophthalmia neonatorum by the use of nitrate of silver as a prophylactic. With the assistance of Dr. Richard Derby of New York and State Senator Laughlin, a law was finally passed, which later led to the passage of similar laws in many other states, and which was an important factor in the control of blindness so frequently due to this serious disease.

The New York State Medical Society awarded him a medal for valuable scientific contributions. In 1909, he received through the International Ophthalmological Congress at Naples a medal for original work, and only last autumn he received in St. Louis the Leslie Dana medal for his services in the prevention of blindness. In 1909, Bowdoin bestowed on him, one of her most eminent sons, the degree of Sc.B. Dr. Howe was a member of many American and foreign ophthalmologic societies, at the meetings of which he was a well known figure. He served as chairman of the Section on Ophthalmology of the American Medical Association in 1895, and as president of the American Ophthalmological Society in 1919. He established medals for achievement in ophthalmology in the New York State Medical Society and in the two societies just mentioned over which he had presided. Last year he was president of the Eugenics Research Association, a branch of science in which he was much interested.

Having closest to his heart the advancement of ophthalmology, in 1926 he presented to Harvard University the sum of $250,000 to establish a laboratory of ophthalmology. A like amount was added to this fund by gifts from the General Education Board and from Harvard University. Dr. Howe became the first director of the laboratory, and established its headquarters at the Massachusetts Eye and ear Infirmary. In the years to come, this foundation is bound to figure largely in the progress of ophthalmology. Up to the day of his death, he was busily engaged in plans of organization.

His writings comprised a book on universal military education, a two volume treatise on the muscles of the eye, and more than 100 scientific communications covering many aspects of his specialty. The outstanding contributions are the articles on ophthalmia neonatorum, and his papers on the muscular apparatus of the eye.

Dr. Howe had five languages at his command, and was a man of varied tastes. In his early years, he learned much of life on the plains, and later on he lived for some time with the Arabs in the desert, in order to investigate the transmission of ophthalmia in Egypt. In the comparative leisure of his first years in Buffalo, he reread the Latin classics, of which he was fond. His mind was always youthful, always in search of knowledge. During the summer before his eightieth birthday, he enrolled as a student in Harvard University in order that he might fill in gaps which he had discovered in his knowledge of chemistry.

Such, in a general way, was the life of one of the prominent figures in American ophthalmology. He has left a proud memory, and the Howe Laboratory of Ophthalmology will always keep it alive. He is survived by his wife, formerly Miss Elizabeth Howe of Cambridge, Mass., who was always his close companion and inspiration. Her intellectual sympathy and charm, together with her keen sense of humor, ever supported and strengthened him during their long and happy married life.

GEORGE S. DERBY.

Notes and News

EDITED BY DR. GEORGE S. DERBY

SOCIETY NEWS

Pan-American Medical Association.—A congress of the Pan-American Medical Association was held in Havana, Cuba, from Dec. 29, 1928, to Jan. 3, 1929. The program, arranged by the president, Dr. Fred H. Albee of New York, included four orations on the subjects of surgery, medicine, pediatrics and tropical medicine.

Dr. William J. Mayo gave the oration on surgery and Dr. Lewellys Barker of Johns Hopkins University, the oration on medicine. Papers were read in both Spanish and English.

The congress was representative of the medical profession of the entire western hemisphere. Chapters of the association from the various centers of North America and Central America, as well as from the Antilles, were represented.

One of the recent accomplishments of the association is the establishment of the Pan-American Hospital in New York for the benefit of people speaking the Latin languages.

American Academy of Ophthalmology and Otolaryngology.—The following officers were elected for the year: president, Dr. Harris P. Mosher, Boston; president-elect, Dr. William H. Wilder, Chicago; first vice president, Dr. Frank Burch, St. Paul; second vice president, Dr. Harry Lyman, St. Louis; third vice president, Dr. John H. Dunnington, New York; treasurer, Dr. Secord H. Large, Cleveland; editor of transactions, Dr. Clarence Loeb, Chicago; executive secretary, Dr. William P. Wherry, Omaha; secretary for ophthalmology, Dr. William L. Benedict, Rochester, Minn.; secretary for otolaryngology, Dr. John Myers, Kansas City, Mo.; secretary for instruction, Dr. Harry S. Gradle, Chicago; member of council, Dr. John J. Shea, Memphis, Tenn.; member of Ophthalmological Board, Dr. John M. Wheeler, New York.

During the meeting of the American Academy of Ophthalmology and Otolaryngology in St. Louis on October 18, the Leslie Dana Medal was awarded to Dr. Park Lewis, Buffalo, vice president of the National Society for the Prevention of Blindness. The medal is given by Mr. Dana through the Missouri Association for the Blind of which he is a director, and on this occasion was presented by Dr. Edward Jackson, Denver, editor of the *American Journal of Ophthalmology*. Dr. Lewis has been in practice for fifty years. He is one of the three persons who established the New York State Committee for the Prevention of Blindness in 1908, which developed later into the National Society for the Prevention of Blindness. Dr. Lewis has been one of the foremost leaders in this work since the society was organized. The inscription on the medal reads "To Dr. Park Lewis, physician, scholar, humanitarian — for life long devotion to the prevention of blindness, 1928."

The program of the St. Louis Medical Society on October 16 was given under the auspices of the American Academy of Ophthalmology and Otolaryngology. Dr. Allen Greenwood, Boston, spoke on "Relation of the Eye to General Diseases," and Dr. Perry G. Goldsmith, Toronto, on "Treatment of Common Ailments of the Ear, Nose and Throat in General Practice."

Oregon Academy of Ophthalmology.—At the annual meeting of the academy, held at the University Club, Portland, on Jan. 24, 1929, the following officers were elected for the ensuing year: Dr. Joseph L. McCool, Portland, president; Dr. L. O. Clement, Salem, first vice president; Dr. J. W. McCollom, Portland, second vice president; Dr. A. J. Browning, Portland, secretary-treasurer.

The academy extends a cordial invitation to members of the Section on Ophthalmology and the Section on Laryngology, Otology and Rhinology of the American Medical Association to visit Portland during the annual session.

Information concerning the meeting, not otherwise covered by the official bulletin, may be secured by addressing a personal communication to either the president or the secretary of the academy at Portland.

Vancouver Oto-Ophthalmological Society.—Dr. Joseph L. McCool of Portland, Ore., was the guest of honor of the Vancouver, B. C., Oto-Ophthalmological Society at its December meeting.

Chicago Ophthalmological Society.—The Chicago Ophthalmological Society is sponsoring a course of instruction in the microscopy of the living eye at Rush Medical College, on Tuesdays at 3 o'clock, by Dr. Robert von der Heydt.

UNIVERSITY NEWS

Haywood M. Taylor, chemist for the Fisk Rubber Company, has accepted a position as head of the department of chemistry in the Wilmer Ophthalmological Institute of Johns Hopkins University.

DEATH

Dr. A. E. Ewing of St. Louis died suddenly on January 26.

Abstracts from Current Literature

EDITED BY DR. WILLIAM ZENTMAYER

Physiology

RESEARCHES ON THE CENTRAL AND PERIPHERAL LIGHT SENSE IN DISEASES OF THE OPTIC NERVE. A. CUCCHIA, Ann. di ottal. e clin. ocul. **56**:385 (May) 1928.

The work of Lo Cascio, who investigated the peripheral retinal zones with Nagel's adaptometer, is quoted. He found a zone of maximum light sensitivity from 20 to 30 degrees above the fovea. Peripheral to from 40 to 50 degrees, the light sensitivity decreases rapidly. The macular region was slightly less sensitive than the upper, inner and outer quadrants, and about the same as the lower quadrant. Lo Cascio devised a simplified adaptometer, which the author used in investigating a series of cases. To this apparatus, the author added an arrangement of horizontal and vertical perimetric arcs which gave eight fixed points for the adaptometer. Tests were made after thirty minutes of adaptation to the dark. The observations with this apparatus on eleven normal persons confirmed those of Lo Cascio as regards the various areas of retinal sensitivity. Twenty-two patients, chiefly with optic neuritis, were also examined. It was found that in conditions in which the central vision had been much reduced for some time, the central and peripheral light sense was reduced. In a number of patients with rather poor central vision, however, and in amblyopic eyes with strabismus, the light sense was well preserved. In fresh cases in which a favorable outcome was later observed, the light sense remained normal, even when the central vision was reduced to 1/10 or less. The relative sensitivity of the various retinal zones was always preserved. The relation between the peripheral and central light sense was always the same, even in the presence of a relative central scotoma.

THE NORMAL PRESSURE OF THE CEREBROSPINAL FLUID. P. NICHELATTI, Ann. di ottal. e clin. ocul. **56**:887 (Oct.) 1928.

The importance of using a manometer is emphasized, not only to record the initial pressure, but to judge when the pressure has been reduced so that no more fluid may be safely withdrawn. It also is valuable in recording the pressure under special conditions. The normal variations in pressure, with changes in posture, indicate an unobstructed path between the ventricles and the spinal canal. The failure of pressure to rise after compression of the jugular veins indicates an obstruction of this pathway as when the medulla is compressed in the foramen magnum. Failure of the pressure to respond to compression of one jugular vein alone may show thrombosis of one lateral sinus.

An estimation of the pressure in the retinal vessels by Baillart's dynamometer will reveal an increased intracranial pressure before choked disk occurs. If this fact is not confirmed by the pressure recorded when a lumbar puncture is performed, a block must be suspected.

Estimates of the normal pressure vary considerably, owing to differences in the technic with which the test is performed. Using the manometer of Claude, the author found that in fifteen normal persons, the average pressure in the horizontal position was from 10 to 20 cm. of water, and in the perfectly erect position, from 48 to 52 cm. The more the head was inclined forward, the less the pressure, which varied from 22 to 41 cm. when head and trunk were flexed.

When the patient was in the erect position, uniformity of technic was easier to secure, and the variations in pressure observed were less. On the other hand, oscillations due to breathing and pulse, which verify the absence of block, were easier to observe when the patient was in the erect position. Even when the oscillations were slight, Queckenstedt's test, which consists of an increase of pressure during pressure on the jugular vein, always gave positive results.

The headache and nausea occurring in some patients after lumbar puncture was considered due to hypotension from a continued escape of fluid through the needle hole after removal of the needle. It occurred in several patients from whom fluid was not removed; hence, it could not be due, as some authors have claimed, to a secondary hypertension resulting from the removal of fluid. Changes in the eyegrounds were never observed. The symptoms were minimized by keeping patients in the prone position, with the head lower than the feet, for three or four days.

S. GIFFORD.

Refraction and Accommodation

RACE, SEX AND ENVIRONMENT IN THE DEVELOPMENT OF MYOPIA. PRELIMINARY COMMUNICATION. A. SOURASKY, Brit. J. Ophth. **12**:107 (April) 1928.

This study was conducted among the Jewish and non-Jewish population in the East End of London. The author points out that the Jewish children are almost all born in England. In the vast majority of cases, their parents are of Polish and Russian origin. They are brought up much as the children of the non-Jewish population, except that the boys who attend the elementary day school also attend classes for the study of Hebrew several evenings each week under conditions which are by no means ideal.

He gives the following summary of his observations:

1. The incidence of visual defects among Jewish boys in the East End is more than 40 per cent — double that of the non-Jewish boys.

2. This heavy incidence of defects among Jewish boys is stationary all through their school life; it is practically no heavier at the age of 14 than at 7.

3. The incidence of the defects, therefore, is not increased with school life, and apparently is not produced by the excessive amont of work done by Jewish boys.

4. Comparative analysis of the refractive errors seen among the defectives of the Jewish and non-Jewish children reveals little difference in the distribution of errors, apart from a rather higher incidence of myopia and of low hyperopia among Jewish children.

5. There is little difference in the percentage of cases of myopia in the early years of school life (from 5 to 9) in the two groups. The greater incidence of myopia among Jewish children becomes marked in the later years (from 10 to 14).

6. It is argued that the greater increase of myopia in the later years among Jewish children is not the result of excessive close work, but of the greater incidence of low hyperopia among the young Jewish children.

7. An attempt is made to establish this contention mathematically.

8. When the analyses are carried further to bring out any distinction in the increase in the number of cases of myopia among Jewish boys as compared with that among girls, it is found that the increase is decidedly greater among the boys (who do much more close work).

9. However, the same is seen to be true of the non-Jewish boys (who do not do an excessive amount of close work) as compared with the non-Jewish girls.

10. It is suggested, therefore, that there is a sex determined factor which controls the growth of the eye.

11. The excessive incidence of myopia among Jewish boys is explained by the racial factor of the great prevalence of low hyperopia and the sex determined (and nonracial) factor which allows for a greater or longer development of the length of the eye.

THE GROWTH OF THE EYE AND THE DEVELOPMENT OF MYOPIA; A STUDY IN THE CHANGES OF REFRACTION DURING THE SCHOOL PERIOD. A. SOURASKY, Brit. J. Ophth. **12**:625 (Dec.) 1928.

The material used for this investigation consists of the "follow up" records of the school clinic of the Tottenham Urban District Council. Some of the records date back to 1915. The children were between the ages of 5 and 14. The refraction was done by one person. Retinoscopy was done under the influence of scopolamine. The selected material came from 1,242 eyes. These were divided into two groups, one containing 395 cases of hyperopia, including hyperopic astigmatism, and another containing 226 cases of myopia, including myopic astigmatism, mixed astigmatism and other cases containing a myopic element.

Under "no change" were included all cases which did not show change in refraction or a change of $+0.5$ or -0.5. In astigmatism, when axes developed at unequal rates, any difference up to and including $+0.5$ or -0.5 was ignored, and when there was a difference of from 0.5 to 1 it was divided and added to each axis. When the difference was greater than 1 diopter, the case was considered irregular.

The author's summary is as follows:

When traced for a period of from three to five years, about 65 per cent of the patients with hyperopia did not show any reduction. Of the remaining cases, a reduction of more than 1 diopter was seen in only a few.

Rather similar proportions were obtained for the smaller number of cases followed up for from six to eight years, as far as the percentage of cases which did not show reduction is concerned; for those cases that do show reduction, the tendency is for the reduction to be rather heavier.

In all probability, these considerations apply equally to all degrees of hyperopia, whether near the emmetropic margin or more than 6 diopters.

About 35 per cent of cases of myopia appear to be stationary when followed up for between three and five years; and about 15 per cent show an increase of not more than 1 diopter; it is only in the remaining 50 per cent that the progression is seen which one associates with all cases of myopia.

Unlike the conditions seen among patients with hyperopia, the different degrees of myopia appear to behave in a different manner. Thus, low myopia seems to tend more toward progression than medium and high myopia, and mixed astigmatism.

A consideration of cases of abnormal development reveals that some cases of hyperopia developed more on the lines of the rapid progression seen in myopia than on the relatively stationary condition or slow progression usually obtained in hyperopia. Much of the evidence brought forward is concerned with the unequal development seen in the two eyes of one person.

Similar unequal development is shown to exist among patients with myopia.

It is concluded that not only may there be a varying rate at which the eyes of different persons develop, but also that the two eyes in the same person may

develop at a different rate, and, incidentally, the congenital condition of most cases of anisometropia is questioned.

Mainly in view of the fact that there are: (1) some cases of hyperopia changing as rapidly as those of myopia; (2) some cases of myopia remaining as stationary as those of hyperopia, and (3) symmetrical eyes progressing unequally, it is argued that the refractive condition of an eye has nothing to do with the tendency to progression. This tendency is regarded as an abnormal state supervening as readily in the hyperopic as in the myopic eye, and may affect one eye only. That this tendency should be more often seen in myopia is only to be expected, as it induces a myopia when this condition has not existed before. Myopia is the result, not the cause, of progression.

Cases are quoted to illustrate how hyperopia that has been stationary for years suddenly diminishes, without going on to myopia, because of a sufficient hyperopic reserve.

Of the behavior of this disorder which induces elongation of the globe, it is pointed out that it has an evolutionary course, beginning at some period of childhood, and persisting through adolescence (progressive myopia), though it may become arrested at an earlier age (stationary myopia in children), or go on through adult life (malignant myopia). (The usual age of the onset of this disorder is probably somewhere from 12 to 14 years.)

A passing suggestion is made as to the nature of this disorder.

During the school period, the growth of the eye has little effect on its refractive condition.

W. ZENTMAYER.

Methods of Examination

EXAMINATION OF THE MOTILITY OF THE EYE BY MEANS OF PROF. W. R. HESS'S COORDIMETER. A. VAZQUEZ BARRIERE, Arch. de oftal. de Buenos Aires **3**:571 (Sept.) 1928.

The author points out the disadvantages of the usual methods of examining the motility of the eye, which depend on a determination by the patient himself of an error in his vision and to the advantages of Professor Hess's (Zürich) method, by means of which the patient himself traces a graphic rendering of this visual abnormality without being aware of its existence, the patient "believing he is localizing with precision, while we observe his error."

The method is based on the following principle: Normally, the movements of the eye are so coordinated that the ocular axes meet on the plane of the fixed object no matter what the direction of the line of vision. When the excursion of one eye is limited in any direction, this does not occur; the visual axis of the affected eye crosses this plane at a distance from the fixed pointing. This separation of the points of intersection of both visual axes varies with the degree of the limitation of the movements of the affected eye, as well as with the direction of the line of vision, and gives the exact measure of the degree and direction of the limitation.

With this object in view, Hess utilizes a screen of black cloth, divided into degrees by a series of vertical and horizontal lines, arranged as a system of coordinates projecting a spherical surface with a radius of 50 cm. On them is found a series of red spots — points of fixation — placed on two horizontal and two vertical lines which limit two concentric squares, the internal square being formed by three spots to the side, the external one by five, which he calls lines of motion. The interval between the lines is 5 degrees.

For examination, the patient is placed before the screen at a distance of 50 cm., and a red glass is placed before one eye and a green one before the other (preferably the suspected eye), which is thus prevented from seeing any of the red spots or lines. The patient is then given a pointer, to the extremity of which a green thread is attached, which at a certain distance from the end of the pointer is knotted to two other green threads which separate at an angle and are attached to two counter-weights, after passing through pulleys at the upper angles of the screen; this combination permits an easy movement of the knot to any part of the surface of the screen. The patient is then asked to place the green knot over the different red spots successively, any lack of coincidence immediately showing. The results are jotted down in green on the charts which reproduce the screen; the green points are then joined by green lines, and the degree and direction of any deviation is immediately apparent. The smaller square is utilized for major defects, the larger for slight defects. By this means it is easy also to distinguish a paralytic from a spasmodic defect. The merits and working of Hess's apparatus and method are illustrated by five charts.

C. E. FINLAY.

Instruments

INDIA RUBBER IN THE ANTERIOR CHAMBER AND A DESCRIPTION OF AN ANTERIOR CHAMBER IRRIGATOR. W. B. DOHERTY, Am. J. Ophth. **11**:16 (Jan.) 1928.

The patient had an operation for combined cataract eleven years before, with excellent results. A number of small, irregularly-shaped reddish masses, from 1 to 2 mm. in size, were embedded in the crypts of the iris; under the biomicroscope they appeared to be particles of red rubber. There was no evidence of encapsulation. The eye was quiet.

The author has devised an irrigator for the anterior chamber to prevent the entrance of matter into the eye during irrigation. The bulb is of red rubber with sufficient resistance to assure refilling. The glass pipet is expanded into a globe near the point of its insertion into the bulb. Foreign matter in the solution can be seen readily and irrigation discontinued if there is any foreign matter in the solution. The tip of the pipet is dark blue so that its insertion into the anterior chamber can be easily detected. A second model is made in metal with a ball valve attached to the side which enables a more rapid refilling of the bulb.

W. ZENTMAYER.

FIXATION OF THE GLOBE WITH THE ANGULAR FIXATION OPHTHALMOSTAT. A. TIERI, Ann. di ottal. e clin. ocul. **56**:431 (May) 1928.

Various methods of fixation are discussed, most of which are at fault in only fixing one point, and allowing of motility in certain directions. Tieri describes an instrument designed to hold the eye at three points. This is made with two curved branches, each bearing a point, the third point of fixation being at the junction of the two branches with the handle. If this is placed below the lower limbus, the two points fix the conjunctiva on either side of the cornea, and the eye is held at three points.

The author also describes a cataract knife, the handle of which is corrugated on the back side only, so that the operator is less likely to insert it upside down.

S. GIFFORD.

Retina: Optic Nerve

MY LATEST EXPERIENCE IN REGARD TO DETACHMENT OF THE RETINA. J. GONIN, Arch. d'opht., September, 1928, vol. 45.

Gonin presents eight new cases of complete reattachment treated by his method of cautery-puncture. All but one were cases of myopia, including two cases in which operation had been performed for cataract. The patients were all seen relatively soon after the appearance of symptoms. In addition to these two, cases with extensive tears were reported with less satisfactory results. A third group of cases of much longer duration which had been subjected to all the usual procedures for the cure of this condition had a still less favorable prognosis. Thermocautery seemed to accomplish more than anything else did, in spite of its late application. In cases in which the local conditions prevent direct approach to the retinal tears, the author had never had such beneficial results from any other method. He states briefly his theory of the pathogenesis of this condition, of which the most important part concerns tears in the retina.

S. B. MARLOW.

Neurology

A BEND IN THE SIXTH CRANIAL NERVE: ITS PROBABLE SIGNIFICANCE. E. WOLF, Brit. J. Ophth. **12**:22 (Jan.) 1928.

Wolf believes that although paralysis of the sixth cranial nerve may be produced in some cases by pressure of the antero-inferior cerebellum artery on the nerve and underlying pons, the structure producing the pressure must be of a firmer consistency. He finds this in the sharp upper border of the petrous temporal bone against which the nerve will be pressed as it is fixed to the pons and more or less held in the cavernous sinus. This condition can occur when, owing to increase in the intracranial pressure, the brain is forced to its largest outlet, the foramen magnum, where herniation may ensue. The medulla and pons will then tend to move downward. Blows on the vault of the skull and compression of the skull in difficult labor may have the same effect.

W. ZENTMAYER.

MULTIFORME SPONGIOBLASTOMA OF LEFT OCCIPITAL LOBE. M. BOLADO and E. BERNASCONI CRAMER, Arch. de oftal. de Buenos Aires **3**:588 (Sept.) 1928.

The patient, a man, aged 34, when first seen, had suffered for five months from cerebral symptoms (headache, vomiting and visual disturbances) followed later by epileptiform seizures without any localizing symptom-drowsiness, polyuria or polydipsia. An examination of the eyes revealed a right-sided homonymous hemianopia with intense papilledema, with numerous retinal hemorrhages on the left side and a normal fundus of the right eye. When he was seen again after some months, he was slightless, with double atrophy of the optic nerve of the postneuritic variety on the left side, with an enlarged sella turcica (roentgenogram). A diagnosis was made of a hypophyseal tumor affecting the left optic tract immediately behind the chiasm. An endonasal operation gave negative observations and was followed by an aggravation of the patient's condition and by a loss of cerebrospinal fluid by way of the nose. A complete clinical examination of the patient yielded the following abnormalities: loss of cerebrospinal fluid by way of the nose; loss of sight in both eyes from atrophy of the optic nerve (in the left of a postneuritic character); orbicular contracture; feminine aspect of the pubis and of the hands and feet; weak tendon reflexes; exaggerated cutaneous reflexes; a positive Kernig reaction; senory hyperesthesia; mental dulness, with puerile

symptoms; cerebrospinal fluid negative with Wassermann and Nonne-Apelt tests, weakly positive with the Dandy test, cellular elements 3 per cent, bacteriologic observations negative, and an irregular febrile disturbance. A diagnosis was made of hypophyseal tumor with probable invasion of the third ventricle. A puncture of the left ventricle was made in the occipital region according to the method of Dandy, with the extraction of hemorrhagic fluid with a 25 Claude pressure, and the injection of iodized oil and air, followed by a ventriculographic examination. The ventriculograms were obscure; a Cushing decompression was made of the right temporal region. An examination of the fluid gave a negative Wassermann reaction, and positive Nonne-Apelt and Dandy reactions, and after centrifugation numerous polymorphic cellular elements with some giant cells were found. The patient died after a few days. The autopsy revealed a tumor of the left occipital lobe, of a heterogenous aspect. Microscopic examination showed a normal hypophysis and a typical spongioblastoma of the left occipital lobe.

The right homonymous hemianopia indicated the correct localization of the lesion, the erroneous diagnosis being provoked by the feminine aspect of the patient, by the presence of polyuria and polydipsia, by the different ophthalmoscopic observations in each eye and by the apparently enlarged sella turcica. All these sources of error could have been eliminated if a ventriculogram had been made at the proper time. The interpretation of the observations was unsatisfactory because of the relative position of the iodized oil to the sella, which showed little alteration in the different changes of position; air did not pass to the other side. A study of the postmortem observations showed that both conditions were confined to the limits of the tumor.

The authors concluded that:

1. The case was one of a tumor of the left occipital lobe, with hypophyseal symptoms — feminine appearance, polydipsia, polyuria, inequality of ophthalmoscopic appearance and enlarged sella turcica — the only typical symptom being the homonymous hemianopia of the right side.

The serious nature of the lesion was determined by the examination of the cerebrospinal fluid and the observation of the presence of tumor elements.

3. The visualization of the extent of the tumor was given by the simultaneous injection of air and iodized oil into its mass.

4. The ventricle of the side opposite that of the suspected lesion should be the one punctured in cases of homonymous hemianopia.

C. E. FINLAY.

Ocular Muscles

SURGICAL CORRECTION OF STRABISMUS. R. ARGAÑARAZ, Arch. de oftal. de Buenos Aires **3**:527 (Aug.) 1928.

The author considers convergence as primarily a voluntary act which is presided over by cortical and subcortical centers, and which through education and biologic inheritance is later transformed into a reflex act. He believes that excessive convergence arises from a toxic lesion of these centers and of those for sight and fusion, and is a contracture resulting from a spasmodic irritation of the lower nuclear centers, which is brought about by the lack of the normal inhibitory action of the superior centers mentioned and is in every way analogous to the contractures of spinal origin developed in different members of the body after cerebral lesions, such as softenings and hemorrhages. After a contracture of this nature has persisted for some time, definite anatomic changes developed in the muscles, fasciae and tissues of the contracted organ which form, in connection with the production of squint, that which he calls functional ankyloses of the orbital

tissues, which are coincident with one-sided or double-sided amblyopia and loss of the sense of fusion of toxic origin.

It is an error to attribute a primitive diplopia, which eventually disappears through the suppression of the image of the squinting eye, to children who squint; the lack of the sense of fusion and amblyopia are also found in straight eyes.

The author concludes that strabismus is the result of a cerebral lesion, of a toxic or infectious origin, which may affect isolatedly or wholly the different sensory or motor centers for vision.

Consequent with these theories and considering that in strabismus the deviation is always bilateral, he advocates a double and simultaneous tenotomy of both interni, accompanied in most instances by capsular detachment, as the most rational and effective treatment of convergent strabismus.

He considers the attempt to correct deviation by operation on a single eye as laborious, as generally imperfect and as giving rise to a one-sided deformity owing to exophthalmus and sinking of the caruncle. In exceptional cases, an advancement, resection or tucking of the opposite muscle tendon may be required, and he gives preference to Lagleyze's modification of de Wecker's folding operation with capsular advancement.

C. E. FINLAY.

SURGICAL TREATMENT OF DIVERGENT STRABISMUS. R. ARGAÑARAZ, Arch. de oftal. de Buenos Aires **3**:583 (Sept.) 1928.

Three forms of divergent strabismus are distinguished: (1) that resulting from a unilateral amblyopia — the amblyopic eye taking the position of anatomic rest owing to the absence of the possibility of binocular vision, which requires a parallelism of the ocular axes and furnishes the stimulus for the necessary muscular action; (2) that resulting from a toxic infectious process during childhood, such as that which occurs in convergent squint, which usually makes its appearance between the ages of 8 and 12 years and less frequently up to the age of 20, which is not benefited by any medical or optical treatment and is progressive, according to Sherrington's law that an excessive stimulation of a motor center is always accompanied by an inhibition of the opposing motor centers; (3) a paralytic variety (which can be treated surgically if it is of more than a year's duration).

Treatment is always difficult and less favorable than in convergent squint. A double tenotomy of the external recti is advocated, which, if the result is insufficient, is followed by a capsulomuscular advancement of the internus of the squinting eye.

C. E. FINLAY.

A CONTRIBUTION TO THE METHODS OF DIAGNOSING PARALYSIS OF THE MUSCLES OF THE EYE. L. GIGER, Arch. f. Ophth. **120**:117 (April) 1928.

A new method, devised by W. R. Hess for investigating disturbances of the muscles of the eye, consists in the graphic registration of the lines of fixation for each eye independently. One eye is led along red fixation marks on a black chart, which represent primary, secondary and tertiary positions in every direction. These fixation marks are invisible to the other eye. The patient has, for example, a red glass in front of the right eye, and a green glass in front of the left eye. The right eye looks at the fixation marks. The patient is asked to cover the red mark with a green cross mounted on a rod which he has in his hand. The place where he puts the green cross indicates the position of the line of fixation for the left eye.

This method applied to cases with muscular disturbances of the eye gives good results, and seems to give new information in determining lesions. The method clearly shows the reduced exursion, the secondary contracture and the changes in the tonicity of the eye muscles. Clinical knowledge of the last point as yet is poor. It is hoped that the new method combined with others will broaden the conception of disturbances of ocular motility.

P. KRONFELD.

Tumors

PERITHELIOMA OF THE ORBIT. R. W. BLEDSOE. Am. J. Ophth. **11**:21 (Jan.) 1928.

In a healthy boy, aged 11 years, the growth had made its appearance three and one-half months before examination. A nodular mass occupied practically the entire upper half of the orbital cavity and extended backward under the supra-orbital rim. The vessels of the fundus were normal.

The tumor grew rapidly, and one month later was extirpated in its capsule. It originated from the periosteum of the roof, 1 cm. behind the orbital rim. The pathologic report of a perithelioma was made by E. B. Bachman.

After an attack of measles with nephritic complications, two months later, there was evidence of recurrence with rapid growth. Three months from the time of the primary operation, the mass was again removed. The growth had a dense fibrous capsule penetrated by columns of cells. There were many blood sinuses with layers of cells radiating from their walls. A third recurrence necessitated complete exenteration of the orbit, but the tumor grew again and caused death by hemorrhage.

Necropsy showed extension into the antrum, nasal cavity and frontal lobe of the brain.

X-rays and radium were used but at what stage of the disease is not mentioned.

W. ZENTMAYER.

CAVERNOUS ANGIOMA OF THE ORBIT. V. BARLETTA, Ann. di ottal. e clin. ocul. **56**:510 (June) 1928.

In six years, a tumor the size of a small nut developed below the left eye of a woman, aged 51. It did not cause proptosis. Two cubic centimeters of blood was withdrawn at exploratory puncture, the tumor regaining its original size after forty-eight hours. It was removed easily, and the diagnosis of cavernous angioma was confirmed by section.

Masses of young mesenchymal cells were found in the septums between the blood spaces and in the capsule itself. They showed a tendency to assume endothelial characters, proliferating to form capillary spaces which formed larger lacunae when blood entered. This fact was noted especially when such cells invaded the homogeneous fibrinous material which had separated from the red cells in the blood spaces. The author believes that this organization of a thrombus is most important in the pathogenesis of these tumors. A bibliography and six photomicrographs are included.

CAVERNOUS ANGIOMA OF THE ORBIT. L. T. BATTISTA, Ann. di otal. e clin. ocul. **56**:907 (Oct.) 1928.

A man, aged 20, for four years had noted unilateral exophthalmos which measured 8 mm. at the first examination by the author. The eye was turned in; vision was 8/10, and a mass could be felt in the upper and outer portion of the

orbit. X-ray showed diffuse clouding of the orbit, and a puncture revealed blood. An external orbitotomy, removing 2 cm. of the external rim of the orbit, allowed removal of the tumor which was inside the muscle cone and extended to the apex of the orbit. Sections showed an encapsulated angioma with some lymphoid elements.

The superiority of orbitotomy by Cirincione's technic over other methods of approaching this area is emphasized. It permits resection of the bone when necessary.

S. GIFFORD.

THE PATHOGENESIS OF SARCOMA OF THE CHOROID. P. WAETZOLD and KATSUTO GYOTOKU, Arch. f. Ophth. **120**:209 (April) 1928.

Waetzold's point of view concerning tumors of the eye has appeared extensively in the last volume of the "Ergebnisse der Pathologie" (Lubarsch-Ostertag, 1927). This paper gives a program for further investigation. The two French authors, Redslob and Mavas, have expressed the opinion that some ("most," according to Mavas) of the malignant tumors of the choroid are of ectodermal origin. Mavas thinks that some of the tumors are derived from the pigment epithelium of the retina, and some from embryonic remnants of nervous tissue, which he assumed to be in the choroid. Waetzold and Gyotoku, who studied material in the eye clinic in Berlin, could not find any embryonic remnants of the neuro-epithelium in the choroid of normal eyes and eyes with malignant tumors. Most of these tumors, therefore, must be sarcomas.

Certain cases of sarcoma show an alveolar structure and decidedly polymorphous cells. Waetzold found among twenty-seven eyes with sarcoma of the uvea, six which showed the pseudo-epithelial cells. He considered it a special type of cells within the group of sarcoma cells. The erosion of the membrane elastica was thought to be a symptom of the origin of the growth from the retina. Waetzold found that it was always due to the infiltrating growth of the tumor. The sarcoma spreads through the whole organism in the two following ways: 1. The tumor cells break into the blood and lymph vessels within the tumor. 2. Tumor cells migrate back along the ciliary vessels and nerves. The second way is more common than the first. Waetzold advises exenteration of the orbit immediately after the diagnosis of sarcoma of the choroid is made. Enucleation does not guarantee the same safety, because the lymph nodules and glands of the orbit contain tumor cells of an intra-ocular sarcoma in early stages.

P. KRONFELD.

SPONTANEOUSLY HEALED GLIOMA. E. VON HIPPEL, Klin. Monatsbl. f. Augenh. **81**:30 (July) 1928.

A man, aged 34, came for an examination of the left eye, in September, 1925. Vision was 10/10 without glasses. The field of vision showed a large scotoma 20 degrees above the point of fixation, owing to the following changes in the fundus: an extremely thin veil over the background, which consisted of the finest kind of a diffuse opacity of the vitreous in front of the retina. A large, vertical, oval discoloration of the pigment layer was seen in the lower field. Rising out of it, up to a height of 6 diopters, a glaring white formation appeared, with an irregular and uneven surface. Some of the protuberances of this formation resembled flat, pendulating lobes, which were arranged in several layers. A few bright red conglomerations of blood vessels were dispersed within the area of the protuberances.

The right eye had been removed because of glioma endophytum at the same clinic at Goettingen, by Schmidt-Rimpler in 1891. The left eye had been considered

normal at that time. The patient, seen by von Hippel for the last time in November, 1927, was unaware of the pathologic condition of the right eye.

In comparing this case with similar reported cases of spontaneously healed glioma with preservation of the sight, the author considers it as closely resembling those of Siegrist and Purtscher, and especially that of Meller. In the author's opinion, the glioma collapsed, shrunk and calcified to some extent. A complete list of the spontaneously healed cases of glioma, and of those temporarily improved by roentgen therapy, can be found in the thesis of Sticherling (On Roentgen Ray Therapy of Glioma, Freiburg, 1927). One patient of the series, treated in this manner, developed recurrences in the neighborhood of the cured areas, which remained unchanged up to the time of the enucleation.

K. L. STOLL.

Therapeutics

INTRAVENOUS INJECTION OF MERCUROCHROME IN SUPPURATIVE EYE CONDITIONS. D. O. DUGGAN, Am. J. Ophth. **11**:39, 1928.

The clinical action of mercurochrome-220 soluble was tested in fifteen infected eyes occurring among twelve patients. It was given intravenously, in doses of 15 cc. of a 1 per cent solution in freshly distilled water. The dose was never repeated before seventy-two hours had elapsed, and not more than three doses were given in any one case. In a few instances, subconjunctival injections of cyanide of mercury (1 : 2,000) supplemented the treatment. Malaise, chill, nausea, vomiting and diarrhea occurred in a large percentage of the cases; in a low percentage, exhaustion and mercurialism were present. The agent was present in the urine, vomit and stools.

The author concluded that mercurochrome is of value in all cases of late infection and hastens the cure of nonsuppurative inflammation of the eye.

W. ZENTMAYER.

MODIFICATION OF THE ACTION OF SOME OPHTHALMIC DRUGS BY POTASSIUM. A. ANTONIBON, Ann. di ottal. e clin. ocul. **56**:403 (May) 1928.

Several authors have claimed that the addition of potassium salts to local anesthetics increases their effect. The author tried to confirm this with respect to the action of cocaine, procaine hydrochloride, benzyldimethylaminoethylpropanol hydrochloride, tropacocaine, eucaine hydrochloride, phenacaine and butamin, and also of the common cycloplegics and miotics on the normal human eye, adding potassium chloride to these drugs to make a concentration of 1 per cent. When the anesthetics were used, the time was noted after the instillation of 2 drops of solution until the corneal reflex was abolished. With the use of 2 per cent cocaine alone, the average time was thirty-one and two tenths seconds, while with cocaine and potassium chloride this was reduced by about half (sixteen and three tenths seconds). A definite reinforcing effect, though somewhat less marked, was noted when 1 per cent cocaine and 2 and 4 per cent procaine hydrochloride were used. With the other anesthetics, the effect of potassium chloride was less marked, although it was fairly definite with stovaine and holocaine hydrochloride.

In the case of the mydriatics, the size of the pupil was noted at intervals until the maximal dilatation. When atropine and potassium chloride were used, mydriasis developed at about the same rate, but a dilation from 1 to 2 mm. greater was produced than when atropine was used alone. A similar reinforcing effect was observed in one case on the increased intra-ocular tension produced by atropine. No increase in the amount or duration of cycloplegia was noted.

A definite reinforcement of the mydriatic effect of scopolamine and atropinemethyl nitrate but not of homatropine was noted.

With the use of eserine, no increase in the miotic effect was noted, but when pilocarpine was used, this increase was definite, averaging 0.6 mm. A definite increase in the effect on tension was also noted when eserine was used in two normal eyes, while in a case of glaucoma this difference was marked.

The definite reinforcing effect of potassium chloride on the action of some drugs must be considered as an example of true synergism, as potassium chloride alone causes no effects similar to those of the other drugs. This synergism might be explained by an action of potassium on the cells, which makes them more permeable to the associated drugs, but why this effect should be apparent only with certain drugs cannot be explained.

The author suggests that this synergistic effect may prove of practical value in the use of eserine for the treatment of glaucoma.

S. GIFFORD.

SPECIFIC THERAPY IN SYPHILITIC OCULAR DISEASES: THE IMPORTANCE OF THE WASSERMANN REACTION ON THE SPINAL FLUID. G. SCALZITTI, Ann. di ottal. e clin. ocul. **56**:481 (June) 1928.

In tertiary and hereditary syphilis, when the Wassermann reaction of the blood may be negative, that of the spinal fluid is nearly always positive. In early neurosyphilis the spinal fluid may give a negative Wassermann reaction, but usually an increased cell count or an increase of globulin will indicate the presence of inflammation. Whereas results with arsphenamine are often brilliant in optic neuritis, opinions differ as to whether it should be used in optic atrophy. Experiences of others with bismuth therapy are quoted. Fourteen cases are described, chiefly of interstitial keratitis and ophthalmoplegia, in which the author administered bismuth. The lesions of interstitial keratitis cleared up rapidly and apparently permanently but the Wassermann reaction of the blood remained positive in these cases, even after long courses of treatment. Bismuth therapy was inferior in results to mercury and arsphenamine combined in the case of ophthalmoplegia. The author concludes from this experience that treatment with mercury and arsphenamine combined is preferred to that with bismuth. Bismuth is of value, however, in certain cases in which the other drugs cannot be used.

S. GIFFORD.

TREATMENT OF OCULAR TUBERCULOUS LESIONS BY SMALL DOSES OF TUBERCULIN. E. B. DEMARIA, Arch. de oftal. de Buenos Aires **3**:539 (Aug.) 1928.

Following a general consideration of the action of tuberculin, especially in ocular tuberculosis, and a brief review of recent German literature on the subject, the author gives an account of Viton's (Buenos Aires) method of administering tuberculin. He begins by giving infinitesimal doses of 1:1,000,000,000,000, which he gradually increases to 1:1,000,000,000, to 1:000,000,000,000,000 or to 1:10,000,000,000,000,000,000,000,000, according to the effect produced. The author employs a modification of this method without making use of Viton's extremely small doses. He divides his patients into two classes: (1) those with phlyctenular ophthalmia and torpid tuberculous keratitis or scleritis, to whom he gives Koch's tuberculin in doses of from 1:1,000 to 1:10,000, and (2) those with internal lesions (iritis, iridocyclitis and choroiditis retinitis) to whom he gives dilutions of 1:10,000,000,000,000,000,000, which doses he gradually increases, according to the Denys-Dessy method. Most of the author's patients had cases of phlyctenular ophthalmia.

C. E. FINLAY.

THE STERILE BACTERIAL FILTRATES OF BESREDKA AND THEIR THERAPEUTIC USE IN DISEASES OF THE EYE. G. ELKES, Ztschr. f. Augenh. **3**:135 (June) 1928.

Elkes describes the preparation of Besredka's filtrates, explains the theory of their action and maintains their particular suitability for use in ophthalmology. He cites observations indicating that the eye, particularly in external diseases, responds poorly to passive and active immunization by way of the blood stream, and conversely that specific infections in the eye do not produce protective bodies in the blood serum. He attributes to this the failure of specific vaccine or serum therapy in infectious diseases of the eye.

Local diseases of the eye, on the other hand, produce local immunity, varying in degree and duration with the disease. This the writer attributes to a histogenetic or cell immunity comparable to that found in Besredka's observations on other tissues like the skin. The filtrates for local use are based on Besredka's experiment which shows that a filtered culture of staphylococci can be sterilized by heat, thus destroying the toxin, which is thermolabile, but leaving a thermostabile fraction which prevents or inhibits the growth of newly planted staphylococci. However, as other bacteria grow in this medium, the action is regarded as specific for staphylococci. Experiments on cultures of other organisms produce analogous results.

This antivirus is used for local application to the focus of infection and has the advantage over antiseptics in that it is not injurious to the tissues. Another theory of its action is referred to, namely, that instead of destroying the bacteria it stimulates cell immunity.

The writer refers freely to favorable reports in the literature dealing with superficial diseases of the eye and cites twenty-seven cases of his own. Owing to the length of time required for the manufacture of the filtrate, Elkes used stock preparations. Half of his cases were hordeola, the course of which he regards as greatly shortened. He opens suppurative processes and then applies tampons soaked in antivirus. He is particularly well satisfied with the results in dacryocystitis, and gives details of several cases. While the short time of observation does not warrant definite conclusions, he feels that a therapy which often produces such quick improvement in obstinate processes like dacryocystitis and is easily administered and harmless deserves continued trial.

A NEW WAY OF TREATING RETINITIS PIGMENTOSA. P. CARSTEN, Ztschr. f. Augenh. **3**:189 (June) 1928.

Since the introduction of the active liver substance in various forms, solid and fluid, it has become actually possible to give a patient some form of liver continuously.

It is indicated in ophthalmology especially for functional and organic diseases of the retina, for which there had previously been no remedy, such as: (1) genuine hemeralopia; (2) the peripheral degeneration of the retina with massive pigment formation (the "pseudoretinitis pigmentosa" of Silex), and (3) the pernicious progressive form of retinitis pigmentosa.

True retinitis pigmentosa is rather rare; the author had only one patient on whom he could try liver therapy. His success with a liver preparation (Ferronovin) was certain and satisfactory.

S. J. BEACH.

Comparative Ophthalmology

THE PROCESS OF DIFFERENTIATION OF THE RETINAL LAYERS IN VERTEBRATES. IDA MANN, Brit. J. Ophth. **12**:449 (Sept.) 1928.

The conclusions drawn by Mann from her study of the process of differentiation of the retinal layers in vertebrates are that there is an underlying principle which remains unchanged as well as an evolutionary scale of modifications superimposed on this.

From a study of the general principle, it is apparent in every case that: (*a*) the ganglion cells are the first to differentiate; (*b*) the amacrine cells are intimately associated with the ganglion cells and are only secondarily separated from them; (*c*) the inner nuclear layer is a complex layer which contains elements derived from both primitive retinal layers (i. e., the inner and outer neuroblastic layers); (*d*) the percipient elements themselves are the last to differentiate. From a study of the secondary modifications of the general principle one sees that: (*a*) supporting tissue differentiates relatively late in phylogeny; (*b*) the abbreviation of stages can occur without modification of the general plan; (*c*) throughout phylogeny there is a tendency to the improvement of function by the crowding together of percipient elements and by the development of special areas of acute vision, the differentiation of which, however, always follows the original general plan.

The article is freely illustrated.

W. ZENTMAYER.

THE TREATMENT OF TABETIC OPTIC ATROPHY BY INFLATION WITH AIR. L. HORN and H. KOGERER, Ztschr. f. Augenh. **64**:377 (April) 1928.

A history of the use of inflation with air in tabetic optic atrophy is given; also the reports of five cases in which it was used with other measures. Inflation was made by the suboccipital route and, in four cases, was followed with the intravenous injection of neoarsphenamine. Malaria inoculation was used also in the fifth case. In this case a decided improvement in vision was maintained for several months. Of the other cases, three showed beginning improvement which, in two instances, lasted. The third patient was influenced unfavorably by endogenous disturbances and the fourth did not show any result from treatment.

These authors differ with Fazakas and Thurzo who explain the cause of the improvement as an increase in the permeability of the blood-spinal fluid barrier. Horn and Kogerer, on the contrary, attribute the improvement to the removal of a large amount of toxin-laden fluid. They were also unable to confirm the observation of Fazakas and Thurzo that the increase in the reaction of the spinal fluid lasted ten or twelve days after the inflation, and that there was hyperemia of the fundus. They attribute their results to the use of smaller amounts of air, not over 15 cc. suboccipitally, or 20 cc. by the lumbar route. They regard the roentgen observations as confirmatory of their theory. Fazakas and Thurzo adopted the suboccipital route as less difficult, less dangerous and requiring less air. In their subsequent work, Horn and Kogerer, however, chose the lumbar route as safer and equally efficient. They state that the changes which actually take place in the optic nerve are never reversed, but that the improvement in symptoms comes from the removal of toxic agents which aggravate the condition. They state that the local treatment can have little, if any, influence on the tabetic process and that indications of the progress of the disease, either in clinical symptoms or in fluid reactions, require other therapeutic measures. Owing to the favorable experience in their second case, in which inflation therapy was combined with malaria, they consider this procedure judicious in all cases which do not show a contraindication to malaria.

S. J. BEACH.

General

A Case of Aneurism of the Anterior Cerebral Artery Causing Compression of the Optic Nerve and Chiasm. S. T. Harris, Brit. J. Ophth. **12**:15 (Jan.) 1928.

A married woman, aged 46, seven years previously had sudden polyopia accompanying a nervous breakdown. Diplopia lasted five months. About six months before admission to the hospital, she had headache and failing vision. The vision of the left eye was 6/60, that of the right eye "even less." The fundi were normal. The right visual field was contracted to about 30 degrees, and there was a large defect, especially in the upper nasal quadrant. For a time following this she was blind. Later, she recovered her sight, but was unable to see objects on the right side. At the time of admission, she had left frontal headache and drowsiness. The neurologic and laboratory examinations were negative. The vision was not accurately tested but was defective in the right eye. There was a complete temporal hemianopia, with the nasal field almost full and fixation preserved. The field in the left eye showed the retention of a small area in the temporal field. Both optic papillae were pale. The vessels were normal. The x-ray examination of the region of the sella gave negative results. Blindness and unconsciousness preceded death. The pupils were at first small but later became dilated, the right fully.

Autopsy revealed the surface of the brain covered with blood, and blood was present in the third and fourth ventricles. A spherical tumor, 2.5 by 3 cm., was found between the inner aspects of the two temporal lobes and in front of the pons. The optic nerves were stretched over the anterior and inferior surfaces and displaced to the left; the right was flattened into a band, the left was oval. A mesial sagittal section of the brain divided the tumor approximately in half, although it projected further into the angle between the inner aspect of the temporal and frontal lobes on the right side than on the left. It was filled with clotted blood, and there was a large rent on the posterior surface and a small opening communicating with the left anterior central artery. From the position of the tumor, it was assumed that the pressure first affected the left optic tract, then the chiasm and later the left optic nerve. Each of the oculomotor nerves appeared on the lateral and inferior aspects of the tumor. The headaches and double vision during the illness of seven years previously were probably due to a small rupture in the aneurysm. Variability in the visual symptoms might perhaps be regarded as a feature by which aneurysm could be distinguished from tumors involving the chiasm and optic nerve.

A local congenital weakness of the wall of the artery was probably the most important factor in the pathogenesis.

W. Zentmayer.

Is Interruption of Pregnancy Necessary in the Amaurosis of Pregnancy, Wrongly Called Uraemic Amaurosis? L. Weekers and R. Missotten, Arch. d'opht. September, 1928, vol. 45.

Weekers and Missotten report the case of a primipara whose pregnancy had pursued a normal course until the sudden onset, in the eighth month of intense headache and repeated vomiting associated with visual disturbance. There was edema of the lids and lower extremities; the blood pressure was 190 systolic and 125 diastolic. The urine contained 8 Gm. of albumin per liter; the blood urea was 30. While under treatment, the patient suddenly became totally blind; the examination of her eyes was entirely negative. As vision returned, a right

homonymous hemianopia was determined. In three days, the visual acuity had returned to normal. A month later she complained of visual disturbances of the left eye at which time an albuminuric neuroretinitis was first noted, the right eye becoming involved similarly two days later. The vision was much reduced by these changes. A healthy baby was born at term shortly afterward. The mother was seen after another month and had normal vision.

After reviewing the literature and discussing the underlying causes and the probable site of the lesion in the occipital cortex, the authors concluded that: 1. The visual prognosis is generally favorable. Incomplete recovery and the persistence of a homonymous or double hemianopia, however, have been observed. Similar visual disturbances somtimes accompany optic nerve and retinal changes. Amaurosis can consequently be an imperative indication for the interuption of the pregnancy. 2. The amaurosis of pregnancy does not necessarily mean a particularly severe general intoxication and involves no more special danger to the life of the mother than to that of the child. It does not of itself constitute an urgent indication for interference. Schiotz insists that one must not be guided by this symptom alone but by the whole clinical picture. 3. Dabadie is of the opinion that with each gestation the vision becomes more and more involved. The authors agree with the contrary opinion of Schiotz, who has observed patients affected at the first pregnancy pass through several subsequent pregnancies without serious consequences.

S. B. MARLOW.

Society Transactions

THE NEW YORK ACADEMY OF MEDICINE, SECTION OF OPHTHALMOLOGY

EDITED BY DR. GEORGE S. DERBY

THOMAS H. JOHNSON, M.D., *Secretary*

Monday, Oct. 15, 1928

B. SAMUELS, M.D., *Chairman*

THE RELATION BETWEEN THE POSTERIOR SINUSES AND THE DISEASES OF THE NERVUS OPTICUS. DR. GEORGE WEILL.

This paper will be published in full in a later issue.

DISCUSSION

DR. THOMAS H. CURTIN: In cases of retrobulbar neuritis not only should the patients be examined for multiple sclerosis and accessory sinus disease, but the entire body should be searched for focal and systemic infections. In my practice, I seldom detect multiple sclerosis in this type of case, but I encounter disease of the posterior ethmoid and sphenoid cells frequently, particularly when the ocular infection is unilateral. Even though the clinical observations are indefinite, even negative, there is frequently marked improvement in visual function after operation.

DR. MARTIN COHEN: In a study of several hundred cases of posterior ethmoiditis and sphenoiditis, in the majority of which the patients were not operated on, I did not find any evidence of retrobulbar neuritis. I believe that acute retrobulbar neuritis may exist with posterior sinusitis, because such association has been recorded from reliable sources, but in such cases I advise against surgical intervention until definite clinical and x-ray data can be obtained. I feel that the etiology of retrobulbar neuritis may be found elsewhere than in the sinuses or in focal infection.

I have not had much experience with the diagnosis of multiple sclerosis in cases of acute retrobulbar neuritis. I have one patient who had at the onset a typical picture of acute retrobulbar neuritis, and who developed in time the classic signs of multiple sclerosis, with complete secondary optic atrophy.

DR. SIGMUND AGATSON: In about 30 per cent of the cases of multiple sclerosis that I have seen, the patients show pallor of the temporal side of the disk. I feel that there is no question of the frequency of retrobulbar neuritis in multiple sclerosis.

THE RÔLE OF THE THREE T'S AND THE REFORM DIET IN OPHTHALMOLOGY. DR. GEORGE H. BELL.

Toxemia from food intoxication, bad teeth, and diseased tonsils figure in ophthalmology, and should always be investigated thoroughly before a patient is put on the reform diet. The reform diet consists of: (1) no mixing of heavy starches and proteins at the same meal; (2) no combination of fresh fruit and heavy starches; (3) no combination of fats with concentrated proteins and (4) a reduced intake of sugars.

In a case of chronic conjunctivitis with edema of the upper and lower lid, cure was effected by the extraction of eleven infected teeth, and by placing the patient on the reform diet.

Fifty patients with chronic glaucoma were given 2 per cent nitrate of pilocarpine in the eyes three times daily, all infected teeth were extracted, diseased tonsils were removed, the colon was irrigated once a week and the reform diet was prescribed. None of these patients has as yet come to the operating table. From ten years' experience with its use, I feel that the reform diet is no longer an experiment, but that it gets results, and that it should be used widely.

DISCUSSION

DR. LOUIS F. BISHOP: I agree with Dr. Bell in every respect, and particularly believe in tonsillectomy and in frequent purgation with castor oil.

DR. JAMES J. KING: I believe that infections are primary in teeth, tonsils and in the genito-urinary tract, and that all other foci of infection are secondary to these. I believe that infections of the sinuses can be prevented by keeping the nose and mouth free from infection. I have seen numerous cases in which marked improvement followed extraction of diseased teeth or removal of infected tonsils.

DR. JAMES G. DWYER: I should like to urge more careful diagnosis before indiscriminate surgery is undertaken to remove focal infection. I believe that focal infection gives trouble when blood is transformed into lymph, as in a joint synovia, or in the iris or ciliary body, and further that focal infection is harmless unless the pus is under pressure. The pus of pyorrhea is harmless, but the pus of an abscess at the root of a tooth is dangerous because of the pressure of the bite. Likewise, tonsillitis in the unscarred tonsil of a young child cannot compare in ill effects with the same process in a tonsil bound up in fibrous tissue wherein the pus accumulates under pressure.

I believe that nasal sinuses play a much smaller part in focal infection than do teeth or tonsils, but they may contribute to reduced visual acuity through swelling of the adjacent tissues and mechanical pressure on the optic nerve.

DR. ROBERT H. ROSE: I agree with what Dr. Bell has said about diet. The American people are overfed, but often undernourished. They are overfattened, but undermineralized, underproteinized and underalkalinized. With excessive weight goes arterial disease and diabetes. It is reasonable to say that the average person overeats starch in all his meals. A century ago, about 90 pounds of sugar per capita were consumed per annum, now about 150 pounds are consumed. Naturally, diabetes results; this affects the eyes. Dr. Bell's diet reduces the amount of sugar intake, and it supplies the alkalis, the minerals and the roughage. According to Sherman, 50 per cent of the people of this country are suffering from a calcium deficiency in their dietary. The result is almost universal caries and apical infections, with the possibility of involvement of the eye in many cases.

DR. N. PHILIP NORMAN: The inexperience and lack of understanding of the average physician with regard to so necessary a therapeutic agent as the diet is unfortunate. Mixed meals which have nothing more to commend them than tradition and imitation should be condemned and should be substituted by purposeful food combinations which cut down on the concentrated carbohydrates, fats and proteins, and supply the necessary bulk, with minerals and vitamins added in sufficient amounts. I strongly commend that each physician learn more about such a diet as Dr. Bell touches on.

DR. CHARLES H. HIGGINS: Dr. Bell's presentation will be the precursor of further work on diet by medical men. He speaks of acid-ash, and of alkaline-ash

foods. The latter consist of any vegetable growing beneath the ground, or any vegetable having a large leaf which is eatable, and these should be consumed with our other diet.

ROYAL SOCIETY OF MEDICINE, LONDON, SECTION ON OPHTHALMOLOGY

Oct. 12, 1928

CYRIL WALKER, *President, in the Chair*

SUBLUXATION OF THE LENS. MR. HUDSON.

At first it seemed that the condition might be a glioma of the retina, but, on further examination it appeared to be a developmental abnormality, namely, persistence of the posterior vascular sheath of the lens. In favor of this was the presence of vessels passing across the surface of the iris and bifurcating at the pupillary margin. Another feature which pointed in the same direction was the condition of the vessels of the iris. It seemed to the exhibitor to be a primitive form of vascularization of the iris. One could also see the ciliary processes drawn out toward the white mass, showing finger-like processes in the gap between the iris and the border of the lens. The lens was dislocated forward. Owing to the absence of the suspensory ligament from the part in which the lens was subluxated, there was an unusual prominence of the anterior surface of the lens, so that the iris was pushed forward against the cornea in the upper and outer quadrant.

DISCUSSION

MISS IDA MANN: I agree with Mr. Hudson that this case was congenital in causation. The main area of the iris resembled that seen from the seventh to the eight month, at which stage atrophy of the central portion of the vascular capsule had not proceeded so far as it normally had. Long-drawn-out ciliary processes are often seen in maldeveloped eyes, and they seem to be common in congenital dislocation. I consider that these processes are due to persistence of the adhesion of the ciliary processes.

MR. R. AFFLECK GREENES: I should like to refer to a similar case which I described a few years ago, the eye having been removed. In that case there was a persistent hyaloid artery, and apparently the blood was still circulating through the capillaries in the mass of tissue at the back of the lens.

MISS MANN: In case of an implantation cyst in the anterior chamber, there was nothing in the history which suggested a cause, though the father said that the patient had fallen on that side when a child, but treatment was not sought. The patient was presented because of photophobia and lacrimation. There seemed to be two cysts; the larger one did not alter, but the other emptied itself every two or three days.

CHRONIC CONJUNCTIVITIS OF ONE EYE. MR. HUMPHREY NEAME.

In a case of chronic conjunctivitis of one eye, the upper lid showed in its upper two-thirds, a swelling of the conjunctiva, which was much engorged. There had not been much discharge from it at any time. A small piece of conjunctiva had been removed and sectioned, and it showed small round cell infiltration, though it was nowhere intense. The central portion had been subjected to six applications of carbon dioxide and that was now the flattest part.

OLD RETINAL DETACHMENT RESTORED WITHOUT OPERATION. MR. HUMPHREY NEAME.

In 1911, the patient, a woman, had two retinal detachments, when vision went down a good deal; since 1911, it had remained at 6/18. The appearance of the fundus strongly suggested old choroiditis.

LATE RESULT AFTER MUSTARD-GAS BURN OF THE EYES. MR. HUMPHREY NEAME.

Since his injury in the World War, the patient had been earning a living as a clerk, as it had not been necessary for him to cease work on account of the condition of his eye. In one of the eyes there was now pallor round the cornea and in the palpebral fissure, with engorgment of vessels peripherally; there was also a depressed scar with an opaque margin.

MR. J. F. CUNNINGHAM showed photographs of eyes damaged by mustard gas in the World War.

DISCUSSION

MR. J. H. FISHER: I believe that the first of these cases was an artefact condition.

SOME RECENT CHANGES IN THE INCIDENCE OF OPHTHALMIC DISEASES. CYRIL WALKER.

The remarks of Mr. Walker concerned the Bristol district, in which he had been practicing as an ophthalmologist for thirty-eight years.

CASE OF CYST OF THE CONJUNCTIVA. MR. E. WOLFF.

Implantation cyst arose by the traumatic implantation of skin, epithelium or hair bulbs into the underlying connective tissues. Parsons said that a cyst was produced by degeneration of the central part of the epithelium; and that it increased in size by the secretion of epithelial cells which were, so to speak, invaded, and also, probably, by a desquamation of the innermost cells. The contents of the cyst vary according to the type of epithelium producing them. They may contain clear watery fluid, mucoid material, hairs or sebaceous matter, and in sheep such cysts may contain wool and fat. They are most common in the fingers and in the palm of the hand, where they may follow puncture wounds. In the conjunctiva their occurrence is uncommon, but they may develop there after injury or after wounds from tenotomy, also around foreign bodies. Uhthoff stated that the differential diagnosis was easily made from lymph cyst by the fact that the latter was placed in the superficial layers of the conjunctiva, whereas the implantation cyst was obviously deep in it.

The case on which this contribution was based was a man, aged 60, who, five years before presentation, was struck in the right eye by a piece of coal. Satisfactory healing followed its treatment. Three years ago, however, a swelling had started around the site of the wound, and had been growing since. The patient was noted to have a cystic translucent swelling, which protruded from between the lids and prevented closure of them. For the most part it was on the inner side of the cornea, but it bulged over the upper and inner part of this structure. There was some choroidal disturbance far forward on the inner side, and some nebulas were seen on the cornea.

Last May, the eye having been cocainized, 2 per cent procaine hydrochloride was injected subcutaneously all round the tumor. An incision was made through the conjunctiva overlying the cyst, and the latter was dissected out whole. At the site of injury, however, the conjunctiva was firmly attached to the cyst and had

to be removed with the tumor. The eye healed rapidly, and at present appears to be normal. Owing to the nebulas present, the vision was no better than 6/18. The cyst measured 1⅛ by ⅜ by ½, and it contained clear viscid mucoid fluid; the wall of the cyst was lined by several layers of squamous epithelium.

DISCUSSION

MR. TREACHER COLLINS: In a case of my own of the same nature, there was always the question as to whether these formations were really implantation cysts or whether they were downgrowths of epithelium from the surface, i. e., whether there was some connecting link between the surface epithelium and the epithelium lining the cyst.

THE GERMAN OPHTHALMOLOGICAL SOCIETY

PROF. DR. ENGELKING, *Reporter*

Forty-Seventh Meeting, Aug. 6 to 8, 1928

Scientific Session, Morning, Aug. 6, 1928

PROF. WESSELY, *Chairman*

The one hundredth birthday of Albrecht von Graefe was celebrated. The official speech was made by T. Axenfeld (Freiburg i. Br.). The presentation of the Graefe-Medal to A. Gullstrand, Upsala, Sweden, was made by T. Axenfeld. The speech of acceptance was made by A. Gullstrand.

FUNCTIONAL ARRANGEMENT AND DIVISION OF THE RETINA. DR. A. TSCHERMAK, Prague.

The speaker characterized the perimetric division of the retina, on one hand, according to the corneofoveal axis of fixed meridians and parallel circles, and, on the other hand, by Hering's two-axis division, in which the longitudinal section is made perpendicular toward a middle point of junction and the transverse section converges toward a horizontal axis. Experience advises against nodocentric arrangement of the retina; parallel lines in relatively right angled checkerboard formation in central fixation do not seem parallel, but concave; on the contrary, curves of definite hyperbolic formation make the impression exact. Various systems of cutting of the eyeball on a surface perpendicular to the line of vision were graphically projected directly through the middle nodal point, which the speaker keeps in schematic approximation as the point of intersection of the conducting rays for the maximum effectiveness of the circle of divergence (in opposition to the decussation of the middle point of the divergence circle of graphic conduction rays in the centrum of the cross section of rays).

Systematic arrangement of the checkerboard thus made in apparent right angle formation will give the person subjectively the impression which was obtained through the nodocentric propection of a pupillocentric system of cutting. The speaker concludes that heterocentric arrangement exists between the perspectivity center of the dioptric production of images and the functional division center, which is located approximately in the center of the cross section of rays — about 4.4 mm. in front of the middle nodal point, 3.04 mm. distant from the corneal pole. Thus is made a two-axis, vertical-horizontal axis, pupillocentric arrangement and division of the retina. The difficulty lies in the comprehension of a

heterocentric arrangement of the perspectivity center of image production and of the division center which is removed toward the cornea.

PATHOLOGICAL ANATOMY OF RETINITIS CIRCINATA. DR. SEEFELDER, Innsbruck.

In a woman, aged 74, the left eye showed typical retinitis circinata. The right eye showed senile degeneration of the macula. The blood pressure was 200. Otherwise the patient had always been well and strong. Microscopic observations: There was a girdle-like formation of spots composed exclusively of granular fat cells, which consisted, for the most part, of considerably altered pigment epithelium, with some glia cells. Within the area of spots, and medial to the papilla, there were marked retinal changes, the so-called cystoid retinal degeneration, particularly in the region of the macula lutea itself, where there was total decay of the outer nuclear layer and sensory epithelium, with fatty and hyaline deposits here and there. The pigment epithelium was also markedly degenerated. Between the pigment epithelium and choroid, there was connective tissue thickening which was the result of a productive inflammation. The blood supply of this thickening came from the choroid. In this thickening, there was new connective tissue packed with fat cells. Behind the thickening, was a circumscribed hemorrhagic area, closely connected with the choroid; compared with this, there was only a loose connection with the pigment epithelium. Here and there in the choroid, lymphocytic infiltration was observed; otherwise, the conditions were normal. The vascular system of the retina as well as of the choroid was normal; no signs of arteriosclerosis were noted. The changes in the region of these opaque spots, no doubt, came entirely from so-called "disk-shaped" retinal disease. The girdle-like formation of spots was secondary; the central changes, on the other hand, were the important ones. The phenomenon of inflammation cannot be considered primary, since in Ammaun's case (early stage) it was entirely absent. The fact that most patients with this disease are advanced in age, and show manifold and extensive hemorrhages, which are seldom absent, particularly in the later stages, leads to the belief that it is a disease of the vascular system, in spite of the negative observations on the blood vessels. The early appearance of severe disturbances of vision, with almost negative ophthalmoscopic evidence, points to the location of primary changes, not only in the retina but also in the choroid.

DISCUSSION

DR. CORDS, Cologne: I question whether the origin of the disease is choroidal rather than retinal, since the anatomy of the choroid gives no basis for it.

DR. SEEFELDER: The question of why the disease process is limited to the retinal center is allied to the problem of vulnerability of the macula lutea, which is also made manifest in senile macular degeneration. This problem has not yet been solved satisfactorily.

HOW ARE THE EDGES OF A RETINAL TEAR APPROXIMATED? DR. J. GONIN, Lausanne.

Since one or more ruptures of the retinal tissue are the motivating factors for spontaneous detachment of the retina, suitable treatment consists of puncture by means of hot needles, through sclera and choroid tissue, which results in chorioretinal adhesion. To avoid a relapse, these torn edges must be enclosed in a scar. The greatest difficulty is in finding precisely the best point on the sclera where the puncture can be made. Dr. Gonin described the way he makes this localization with the ophthalmoscope according to the meridian and parallel circle.

Errors in estimation are not always avoided; but by a little practice, they will seldom occur, and, in case of need, they can be easily corrected. It must be explicitly stressed that the operation itself is not of sole importance. Preparation for the operation, the finding of the best site and after-care of the patient, all are factors of equal importance in obtaining a good choroid-retinal scar. It is not possible to give a complete outline of these details in the short time allowed, but Dr. Gonin hopes to present them in full in a special journal.

DISCUSSION

DR. THIEL, Berlin: In the Berlin Eye Clinic from Jan. 1, 1925, to July, 1928, sixty-seven patients were treated for detachment of the retina. The eighteen patients treated medically as well as the twenty treated surgically, by means of puncture, were permanently cured. In twenty-nine cases, cauterization plus puncture was used. Cauterization was accomplished in two ways: (1) superficial cauterization with a galvanocautery — Wessely (after the method of Löhlein); (2) puncture cauterization with thermocautery (after the method of Stargardt). In the first method, puncture was done with a knife; in the second method, the thermocautery itself. Of twenty-nine cases, healing was complete in five — that is, an entire attachment of the detached retina and disappearance of the tear.: In but one case, a retinal cyst remained.

Vision was from one-third to one-fourth improved; the field of vision was normal for white and colors, with light and dark adaptation. The puncture was made where the detachment was most pronounced.

DR. COMBERG, Berlin: Dr. Gonin emphasized the fact that in his system of roentgen localization he used sterilized calipers for measuring distance with the best results. A detailed account is found in *Archiv für Ophthalmologie*, 1927. One should choose a definite system of coordinates in order to characterize the place of operation accurately. Dr. Gonin recommended his roentgen localization system which originates from the relationship of polar coordinates (for characterization of meridians) to a drawing of the abscissa for the depth.

DR. MEYERHOF, Cairo: I made the following observations a few weeks ago in Herr Gonin's clinic in Lausanne: The clinic did not have many visitors, since vacation was just over. I saw six patients who had been cured of detachment of the retina. Four patients were young and two were elderly. One patient had recently undergone operation, and the detachment was already beginning to heal. In most of these cases of detachment of the retina, there was only a small amount of pigmentation, the scar of the former tear and that of cauterization. Herr Gonin's system of treatment not only has practical significance, but has a greater significance in the theory and mechanics of retinal detachment. This method should be greatly respected, and practically developed.

DR. LÖHLEIN, Jena: I do not think, even with a more exact method than that described by Herr Gonin, that one can possibly make an exact determination of the location of the retinal tear; for such a determination involves not only a retina in place, but one which has been more or less raised, in which it is difficult to determine the distance of the retinal tear from the sclera and the point fixation, which is uncertain. I do not believe, however, that such an exact determination is absolutely necessary for results. As you have heard from Herr Thiel, I have a system which I have not made public in which I make a surface-like cauterization, followed by puncture of the sclera. As nearly as possible, I perform the cauterization in the neighborhood of the tear, but in the compass of a whole quadrant. I believe that it is not desirable merely to fixate the place of the retinal tear.

DR. GONIN: Contrary to the opinion of Herr Thiel, I would like to say that the method described by me may lead to satisfactory chorioretinal adhesion in some cases, but the proportionately small number shows that one could better accomplish one's purpose in another way. In the demonstration meeting, I will show a case in which unhoped for results were attained through the use of a scleral puncture in a young woman, whose other eye was blinded in spite of the treatment (described by Dr. Thiel) for retinal detachment and cataract in the Berlin Ophthalmologic Clinic. After closing of the retinal tear, there was complete application of new detachments after six or seven days — that is, after the first examination. The possibility of unsatisfactory results should always be considered, for either the tear may not be located exactly, or another tear may appear.

I can agree with Herr Löhlein in saying that the cauterization scar spreads more and more in the course of the following weeks. A wide surface of chorioretinal growth is formed, so that a renewed detachment is excluded at that place.

BANDLIKE ATROPHY OF THE FACE AND EYE. DR. CORDS, Cologne.

The speaker showed a diapositive example of a remarkable facial skin disease which is called sclerodermatitis in stripes or sclerodermatitis en coup de sabre (sword stripes). It is characterized by a complete shrinkage of the subcutaneous tissue in a ridge formation from 1 to 2 cm. wide. It is mostly bluish; the roots of the hair are destroyed, and the hair falls out. Muscles and cartilage in the diseased area are destroyed.

The most frequent localization of the disease is on the face, especially the forehead. The stripes usually go from the eyebrows to the hair of the head without staying in the nerve course.

Formerly, the disease was called sclerodermatitis; now it is considered in connection with facial hemiatrophy. In the latter disease, there is a shrinkage of the whole side of the face, including the bones.

Aside from the falling out of hair and Anderson's observation of the effect on the conjunctiva, as in two cases described in literature on the subject, the effect of this disease on the eye has not been acknowledged thus far.

In the following cases, Dr. Cords found a marked effect of this disease in the neighborhood of the eye.

In a girl, aged 11, a bright spot, painless and without sensitive phenomena, was observed on the left upper lid. In the following years, the upper lid began to droop, and depression of the skin of the exterior part of the eyebrows developed. Somewhat later, double images appeared, which may have been caused by throwing the head backward. In 1923, ptosis was complete.

On March 22, 1925, the skin was deeply sunken over the exterior third of the eyebrow and in a corresponding band of the forehead. In the upper lid, were circular spots, whitish and seemingly smooth. There were marked attenuation of the upper lid and almost complete shrinkage of the tarsal cartilage up to the palpebral margin. The eyelashes and meibomian glands were almost completely shrunken. Ptosis was complete. There was considerable paresis of the superior rectus. Therapy was difficult. Two operations for ptosis by Elschnig's method gave only temporary results. An operation by Hess' method, as well as stretching of the superior rectus, obtained a somewhat satisfactory result. Dr. Cords rejected the opinion that the disease originates as a trophoneurosis, and accepted the old opinion of Möbius — that the general shrinking of the tissue results from a local injury under the skin. The question of what type of injury it is is hardly answerable.

RELATIONSHIP OF TUBERCULOSIS OF THE EYE TO THE GENERAL TUBERCULOUS CONDITION. DR. WERDENBERG, Davos.

1. Observations in the lungs and diseases of the eye: Detailed physical and roentgenologic pulmonary examinations in 150 of 300 patients suffering from tuberculosis of the eye showed no legitimate relationship between tuberculosis of the eye and hilum of the lung; on the contrary, an incongruity was shown by frequent severe conditions of the eye and slight trouble in the lungs, or vice versa (for example, a severe case of tuberculosis of the uvea and of the retinal veins, accompanied by a slight case of tuberculosis of the lung). Further investigation showed: (*a*) that a roentgenologic negative pulmonary condition with tuberculosis of the eye could not be found in the preceding cases; (*b*) that a slight pulmonary condition with tuberculosis of the eye was the outstanding relationship; (*c*) that the foregoing pulmonary condition is to be considered as a dangerous source of secondary disease of the eye; (*d*) that the significance of carefully observed roentgenologic changes in the lung should be considered in the treatment of the disease as a whole.

2. The relationship of tuberculosis as a whole to tuberculosis of the eye shows a significant parallelism between the nature of the principal types of tuberculosis of the eye and the general types of tuberculosis, since the symptoms of an insufficient immunity, toxic general conditions, etc., can be observed much more frequently in hypersensitive exudative types than in benign, proliferating, late secondary types. The cause of the unpredictability of the course of tuberculosis of the eye must be looked for in the nature of the general condition, and in the equilibrium relations between infection and immunity. For better comprehension of this relationship, Ranke's immunity types offer worthwhile support. More important than the quantitative determination of the extent of a tuberculous process in the eye or the lung is the qualitative determination of the intensity (toxicity); this will be explained in detail for tuberculosis of the eye and general tuberculous conditions in a modified Turban classification of pulmonary tuberculosis in a work to be published.

3. Remarks on tuberculin therapy: (*a*) The consequent consideration of the intensity of tuberculosis of the eye and general tuberculosis prevents the all too frequent injuries from tuberculin through tuberculin therapy, and accounts for the complete or temporary counterindicant type of tuberculosis of the eye. (*b*) In the last two years, Werdenberg's experience with 130 cases was that Sahli's subepidermal treatment was the most effective method of tuberculin therapy, which is measurable and controllable. (*c*) As to the dosage, there is no definite amount, only an individual optimal dose. Therefore, to procure the so-called positive "anergie," which must never be forced, only individual — never absolute — amounts of tuberculin are advised.

DEMONSTRATIONS

RELATION OF TUBERCULOSIS OF THE EYE TO PULMONARY TUBERCULOSIS. DR. KRÜCKMANN, Berlin.

Krückmann called attention to the fact that it is important for the ophthalmologist to correct and make exact his knowledge of the area of first invasion and also to find out about the endogenic and exogenic pulmonary infections. On the basis of preparations and diapositives demonstrated by himself, he reached the following result — that the glands which are primarily complicated are responsible for infection of the eye. He placed especial emphasis on the observations in the paratracheal glands, because the lymph flows through these just before

it enters the great lymphatic trunk and goes from there into the pulmonary veins. It seems strange that with this tuberculosis of the glands, and with the passage of tubercle bacilli to the lungs, the lungs can remain uninfected, while the eye becomes hematogenously diseased. Anatomically, Krückmann found the answer in the rapid circulation of the blood in the lungs and gave examples. For demonstration purposes in the eye, he used the cornea and described the opacities caused by tuberculous infection in the first stage. He made comparisons between the pleura and the anterior chamber. He considered particularly the sympathetic infection of the other eye when symptoms in the first eye have reached apoplectic proportions. Parallel to this he mentioned similar conditions in diseases other than tuberculosis, and was inclined to refer a great number of these back to the common effect of the trigeminal nerve and the sympathetic nervous system. He touched on the possibility of the existence of sympathetic irritation.

DISCUSSION

Dr. Best, Dresden: I also would emphasize the significance which Krückmann puts on age in the course of tuberculosis in the transformation in the body as well as in the eye.

Dr. Franceschetti, Basel: Werdenberg's law of the relation between the severity of tuberculosis of the eye and pulmonary tuberculosis holds also in the case of tuberculosis of the bone and pulmonary tuberculosis. The relationship between tuberculosis of the bone and that of the eye is interesting also, and has been little investigated. Dr. Achermann of the clinic at Basel has had the opportunity to observe 100 cases of extrapulmonary tuberculosis (tuberculosis of the bone in particular) in the Rollier clinic at Leysin. None of the patients showed any severe conditions of the lungs; on the other hand, there was frequent infection of the glands. With reference to the eyes, phlyctenular conjunctivitis was found in 5 per cent of the cases, but there were no signs of existing or resulting tuberculosis of the eyes.

Dr. Becker, Naumburg: I would refer, by way of an appropriate case, to a matter concerning the efficacy of the therapy used; that is, the difficulty of judging a means by which results are achieved. A woman, aged 58, developed on the right side a severe tuberculous cyclitis and on the left a severe sclerosing keratitis. Treatment consisted of the injection of tebeprotein, energetic general treatment according to internal control, local atropinization on the right side, the usual treatment and paracentesis on the left side. After five months, there was complete disappearance of the enormous precipitation and complete absence of irritation.

Dr. Stock, Tübingen: I would like to take my stand against that; the indication for therapy is so sharply circumscribed that in certain cases it would be direct malpractice to use tuberculin or ray treatment.

One should always begin by examinations and testing. The really good physician will find out the right therapy, if he studies the case exactly enough; and it is characteristic of a good physician that he introduces a new treatment, contrary to the general rule, with which he cures the patient.

Experimental Investigations with Calmette's B C G Tuberculosis Virus.

Dr. Igersheimer, Frankfurt a. M.

Igersheimer has undertaken, with Schlossberger, experimental investigations on the eye concerning the pathogenesis and immunizing characteristics of Calmette and Guerin's B C G vaccine. It is originally a strong, virulent bovine type of

tubercle bacilli, which may be grown intensively by inoculation into pure oxgall placed in 5 per cent glycerin. In France and in many other countries, it is prepared in great amounts for vaccination uses, especially in suckling babies. If one puts the rather considerable dose of 0.1 mg. of an emulsion of B C G in a room where guinea-pigs are kept, in most cases, after a certain incubation time, a typical tuberculous process appears, with nodules in the iris and opacity of the cornea. The process may be progressive and lead ultimately to perforation of the cornea and phthisis bulbi. It may also be mild, so that the nodule formation in the iris does not exceed a certain degree of development, or so that in the early or late stages of the specific processes phenomena of involution appear. It was especially noteworthy that the tuberculous processes remained localized in the site of inoculation. The regional glands showed, for the most part, little or no swelling, and the internal organs were unchanged, in spite of the most severe tuberculosis of the eye. The results of inoculation on the eye are still more mild in rabbits than in guinea-pigs, although the bovine bacillus is unusually virulent in the former. Since, for the practical evaluation of B C G, there was an apprehension that detention in the warm blooded organism might lead to further increase in virulence, five inoculations were made from eye to eye without any resulting increase in the virulence of tuberculous processes. The immunizing qualities of B C G vaccine are of unusual significance for practical application. Various conditions of investigation were chosen, with previous treatment with B C G vaccine either by infection of the eye or intraperitoneal or stomachal assimilation. Reinfection in the other eye was brought about by either bovine or human virulent tuberculin vaccine. If the reinfection dose is not too high, more or less protection by inoculation can be perceived in the various kinds of treatment. The protection by inoculation occurs either because the process in the reinfected eye took place unusually mildly or because a characteristic delay in its appearance and course was observed. It is especially noteworthy that the observations on sections of the internal organs of these animals which have been treated before either were entirely normal or showed minimal pathologic changes three or four months after reinfection of the eye with virulent material.

DISCUSSION

DR. KRÜCKMANN, Berlin: Perhaps it will be of interest here to mention observations made known to me by my colleague, Herr Czerny. I had the opportunity to see, in two cases, a so-called epituberculous process accompanying the appearance of vesicular eruption; the former had to be conceived as a perihilum infiltration. Once, there was a pronounced localized redness on the temporal half of the eyeball, with eruption of small vesicles (phlyctenules) on the edge of the skin in a girl. I saw something similar in a young man, who had suffered from vesicular eruption, but had been free from it for two years. During a sojourn near the lake, he suffered an extraordinarily severe recurrence of marginal vesicular eruption, with a thickening in the central section of the lung which was thought to be pneumonic, but found to be perihilum infiltration; it lasted about a year, after the vesicular eruption had long disappeared. Although it does not belong to tuberculosis or related diseases, I would like to insert that something similar to perihilum conditions is seen also in transient relationship to acute erythema nodosum.

DR. ENGELKING, Freiburg i. B.: In general, immunity to tuberculosis in man is believed to be dependent on the existence of living tubercle bacilli in the organism.

Therefore, I would like to ask Herr Igersheimer if the eyes which he treated with B C G healed completely, if the animals inoculated showed actual tuberculous processes and if these latter were cured?

How long does immunity last in clinically normal animals after internal treatment with B C G?

EXPERIMENTAL CONJUNCTIVITIS AND PHLYCTENULAR KERATITIS. DR. W. RIEHM, Würzburg.

By subcutaneous treatment, or simply by the instillation of horse serum in the conjunctival sac of a rabbit, it is possible to cause a local sensitization of the eye, which, after a certain length of time, following another instillation of serum, results in a case of anaphylactic keratoconjunctivitis in the rabbit's eye.

In milder forms of this anaphylactic inflammation, nodules with a predilection for the limbus are formed; these nodules are similar to phlyctenules. The stronger the anaphylactic reaction, the more is the cornea affected. First, there is an isolated marginal infiltration; with more severe reaction, there is ultimately a total, finely spotted, deep corneal opacity. If one allows the anaphylactic phenomena to disappear, the local inflammation can be caused to break out, by means of renewed instillation, as well as by the subcutaneous or intravenous injection of serum.

Before the generated eruptions are compared to the phlyctenules of highly anaphylactic scrofulous patients, two questions should be answered: 1. What is tuberculous anaphylaxis? 2. What part is played in it by tuberculin?

Riehm tried to give an explanation which permits the diagnosis of tuberculous anaphylaxis as real anaphylaxis, in which tuberculin plays the part of an antigen, although tuberculin as such is not an antigen in uninfected patients.

It is assumed also, that tuberculin is transformed into an antigen in the anaphylactic organism; thus is found an extraordinarily plausible explanation for the etiology of phlyctenular inflammation of the eye, in which the phlyctenule-like formations in herpes conjunctivae and acne rosacea naturally separate: The basic condition is a sensitization — in special cases also a tuberculous anaphylaxis of the patient. The motivating cause, especially after neglect, is the entrance of tuberculous material into the conjunctival sac; second there is the entrance of minute tubercle bacilli or their poisons into the sensitized eye. Acording to Weekers, it must also be taken into account that in each nonspecific inflammation of the conjunctiva of tuberculous patients tuberculotoxic material has reached the conjunctival sac through the lacrimal fluid in increasing amounts; thus is brought into consideration the third causal factor of the still nonspecific inflammation of the eye which, even in conditions of increased cleansing of specific material, conveys a specific irritation into the lacrimal fluid.

ENDOGENIC AND METASTATIC OPHTHALMIA AFTER OPERATION ON THE EYE. DR. GILBERT, Hamburg.

Thus far, of the endogenic causes of postoperative inflammation of the eye we have considered only the hypersensitivity of the tissue of the eye in relation to the remaining portions of the lens. With the information on hand concerning metastatic ophthalmia after operation for cataract, the proof of the endogenic origin of ophthalmia can be considered successful in a small degree. Assuming the acceptance of this relationship, the following bacteriologic investigation of the conjunctival sac is made with the result of a clean conjunctiva, normal lacrimal duct, smooth course of operation and, on the first day of after-treatment, normal adherence of the wound.

There is information regarding two cases of postoperative suppurating inflammation in which the local and general course indicated that the origin of the

inflammation was not ectogenic; in a third case, the possibility of an ectogenic origin was considered because fourteen days before operation, pneumococci were found in the conjunctival sac. After eight days' treatment, however, pneumococci were not found. That one should not go too far in one's skepticism is shown definitely by the following observation: A woman, aged 67, who had been thoroughly examined, on the day before the proposed extraction of a cataract, was attacked without recognizable cause, by a severe case of iridocyclitis in the eye to be operated on with final seclusion and occlusion of the pupil. If the operation had been performed two days earlier, panophthalmia would probably have appeared, and a decision that the infection was ectogenic could have hardly been opposed. Besides Elschnig's already mentioned bodily examination, it is necessary to obtain an accurate description of the events which took place before. Nevertheless, one will not be able completely to dispose of either endogenic or ectogenic ophthalmia.

DISCUSSION

DR. SCHEFFELS: In forty years, I have observed one case of endogenic postoperative iridocyclitis in a man, aged 76, on whom iridectomy was performed twelve days before the hypermature cataract was removed in capsule in an eye which was absolutely free from irritation. The eye had gained an excellent capacity for sight and was absolutely free from irritation. Twelve days after the operation, the patient suddenly suffered a violent attack of feverish bronchitis on the ground of an old bronchiectasis. The eye operated on, heretofore free from irritation, was attacked by iridocyclitis with hypopyon, and in a short time was blinded from panophthalmia.

DR. LÖHLEIN, Jena: Herr Gilbert's last case reminds me that one must always take into account that, with the exclusion of an ectogenic infection, an endogenic infection may exist, not of postoperative origin, but as a preexisting metastasis in the eye operated on. This is shown in my observations in a boy, aged 12, who had been brought to me three years before for operation on a unilateral ripe cataract.

The cataract appeared a half year before, when the boy was suffering from suppuration of the middle ear, in addition to a septic disease which affected the joints and the heart. It must be agreed that, at that time, a metastatic process had led to the formation of a cataract in one eye. At that time, the eye was completely free from irritation, the iris and aqueous humor were normal and projection was true. Nevertheless, I decided on discission of the lens first, after which the eye remained completely free from irritation for three years. The operation was as successful as possible, but five days thereafter, with normal healing of the wound, a severe iridocyclitis appeared which, after long treatment, was cured. The youth of the patient and the unilateral character of the process demanded, in this case, that a special cause for the cataract be discovered. One can imagine, however, that in a case of senile cataract a similar, already existing, metastatic focus in the inner portion of the eye would not have revealed itself and would have become manifest only through operation.

DR. SCHNAUDIGEL, Frankfurt a. M.: I can report three cases of normal extraction with a condition of severe irritation lasting for three months. In each of these three cases, the other eye was irritated for the same length of time. In two cases, colitis was also found; the third patient was free from this disease.

Here, the question again arises as to how far the intestine is the medium of the infection, which can only come from an endogenic source.

DR. LAUBER, Vienna: Severe purulent inflammation appears after complete healing following an operation for cataract. This was the case in a woman who

was operated on with good results; healing proceeded smoothly, and four weeks after the operation vision was exactly 0.8. Six weeks after operation, severe inflammation with hypopyon appeared and lasted for weeks. It resulted in almost complete atrophy of the iris and below, on the exterior, a yellow focus was visible in the ciliary body. This was evidently a small abscess. Ultimately, the inflammation was cured. Then, secondary glaucoma appeared and was cured by puncture and medication. Eight months after operation, the sight was 0.3.

DR. GILBERT: I am glad to be able to conclude from the numerous observations of others that I was right in the interpretation of my own observations. Accustomed as I am to look for the fault in myself in such unsatisfactory observations, I could not, however, make up my mind to accept an ectogenic origin in the given cases. In Herr Löhlein's report, I find confirmation of my own strongly recommended study of the events which took place before. The observations of Herr Schnaudigel and Lauber confirm my impression that the result of these endogenic infections is better than that of the ectogenic infections.

"RHINOGENOUS" RETROBULBAR NEURITIS. DR. VON HIPPEL, Göttingen.

The speaker discussed seventy cases which he observed in the last fourteen years. In all these, he had never in one single case caused an opening of the ethmoidal and sphenoidal sinuses, but once he advised a resection of the turbinate bone for the purpose of greater bleeding; once a septum resection was made for rhinologic information, and once several operations were performed for purulent inflammation of the frontal sinus. In forty-eight cases cure was obtained, with normal, almost normal or practically complete useful sight. Of the twenty-two patients in whom there was no improvement, twenty were men. All except one case was bilateral; six cases were shown to be familial; seven belonged in the category of stationary scotomatous atrophy (Jensen), and in the rest the patients gave no cause for believing that their condition would be improved by operation. The three cases in which operations on the sphenoidal or ethmoidal sinuses were performed were among those in which there was no improvement. The rhinologic examinations were, for the most part, negative. The "results" of operative treatment rest more or less on deception, and prove nothing as far as rhinologic origin is concerned. Dr. von Hippel refers every rhinologically positive case to the rhinologists; he believes, however, that a relationship to neuritis is not proved. Chance improvements, in case they may really be traced back to the introduction of epinephrine or to the production of bleeding, occur after nonspecific types of operative intervention; basic operative treatment is rejected.

DISCUSSION

DR. SCHEERER, Tübingen: I would like to say that I have the high proportion of from 15 to 20 per cent of cases of retrobular neuritis in which the possibility of rhinogenous etiology could be considered, and, indeed, on the basis of exact rhinologic observations; however, a more certain confirmation of the suspicion has almost always been absent, even in the cases in which the rhinologist decided on operation. Furthermore, I surmise that many people, especially those who suffer from frequent attacks of catarrah, develop slight changes in the mucous membrane of the accessory sinus, but these changes never lead to retrobulbar neuritis, or are erroneously ascribed as causes for it. Such cannot be the case, since these changes are far too numerous, as compared with the number of cases of neuritis.

DR. HERTEL, Leipzig: In the light of my experience, which is supported by a great number of observations in the Strassburg and Leipzig clinics, one should

adhere to the rhinogenous origin of retrobulbar neuritis. The procedure is as follows: To begin with, a careful search is made for all other factors which come to mind with reference to the internal and nervous clinical study. If an etiologic factor cannot be found, disease of the accessory sinus is suspected, and is especially authorized in these cases in which the optic condition is acute and must be considered with regard to therapeutic treatment. Operation is not performed, immediately, but an attempt is made to treat the illness by conservative methods: light baths for the head, acetylsalicylic acid, etc. If there is no improvement in such cases, and if vision or objective observations become worse, it is time for operation, because more will be gained from it than from further consideration of the decline of vision.

DR. SEEFELDER, Innsburk: I have also observed the subjective disturbances which were mentioned by von Hippel, and have already called attention to them at the second meeting of the ophthalmologists of Bavaria (*Klin. Monatsbl. f. Augenh.* **79**:807, 1928—discussion also there). They can be extremely painful, but die away a few days after the treatment has stopped, and are not extensive enough to bring discredit to the whole method of treatment. Together with my colleague, Herzog, I have seen fine and convincing results from this treatment and can recommend it as a substitute for the operative opening of the accessory sinus. If other clinical workers have no had results from this treatment, it is because they have not observed actual cases of rhinogenous neuritis. If one rejects this treatment, one as a rule renounces further intervention. The advantage of Herzog's method is that it makes many operations unnecessary and keeps the patient from undergoing a type of intervention which is far from harmless.

DR. FLEISCHER, Erlangen: I agree with Dr. von Hippel whose standpoint is the same as mine has been for twenty years; that, if another cause cannot be found, acute retrobulbar neuritis in young persons is, in most cases, the first symptom of multiple sclerosis. A striking proof of the small part which nasal diseases play in the origin of retrobulbar neuritis, is the fact that rhinologists themselves do not find cases of neuritis in connection with diseases of the accessory sinus. Von Hippel's standpoint is especially to be praised because operative intervention in the accessory sinus is far from harmless, and can in certain cases lead to death.

DR. STOCK, Tübingen: I wish to say about the same thing as Fleischer. I have never had a patient with retrobulbar neuritis sent to me from the clinic of nasal diseases. I believe that rhinogenous retrobulbar neuritis, if it exists at all, is rare.

DR. BEST: I would like to ask those who recommend operation in cases of rhinogenous neuritis which accessory sinus they decide on, when the rhinologist finds no infection by means of illumination and roentgenograms? It is technically almost impossible to open all accessory sinuses, and it is just the sphenoidal sinus, which should be suspected because of its proximity to the optic nerve, which the rhinologists refuse to open on its own account and without rhinologic indication.

DR. MAYWEG: I can reply to those who have spoken before that I believe it is principally a case of disease of the ethmoidal sinus. In a rather small number of cases of neuritis, I have observed two which were bilateral and in which the neuritis was undoubtedly caused by suppuration of the sphenoidal sinus. The patients had been treated by other methods for quite a time; the first patient was cured with complete visual acuity after opening of the sphenoidal sinus; in the other one, atrophic changes in the optic nerve had already taken place. Nevertheless, after operation, the visual faculty was raised to two thirds of normal. I therefore urgently advise opening of the sphenoidal sinus in cases under suspicion.

DR. SCHNAUDIGEL: One cannot deny the existence of rhinogenous retrobulbar neuritis even though the disease is rare. Only the best roentgenograms help in this case. The sphenoidal sinus can be the cause of the disease just as well as the ethmoidal cells, which in asymmetry of the skull can often change the topographic relation to the optic nerve. I always keep in mind the fact that the optic nerve can easily become involved through the posterior ethmoidal cells.

DR. VON HIPPEL: When the eye becomes blinded at the climax of the disease, it is no more endangered than it is when visual capacity is only slightly diminished. In my experience, I have observed a whole series of cases in which normal visual acuity was regained after complete blindness. Apparently it was intimated that I wished to depreciate the value of other statistics; one can, however, find good material for comparison, if one compares a group of patients who were not operated on with those who have undergone numerous operations. For the rest, I insist that I do not dispute the existence of rhinogenous neuritis, but that I do not consider its exisence to be sufficiently proved.

CAVITY FORMATION IN THE OPTIC NERVE. DR. O. SCHNAUDIGEL, Frankfurt a. M.

The speaker referred to Elschnig's report in the last ophthalmologic congress, discussed the theories of the origin of lacunae and brought in his own experience which proved the relationship between the phenomena of excavation and pathologic changes in the central nervous system (Spielmeyer: "Gliöse Architectonic" of the Basket-Like Formations in the Cerebellar Cortex, in Multiple Sclerosis of the Spinal Cord, in Funicular Disease of the Spinal Cord, Finally in Diseases of the Cerebral Cortex, Histopathology of the Nervous System).

The cases mentioned show three types of lacunar degeneration of the optic nerve: cavity formation corresponding to the cerebral changes mentioned, then diffuse extensions of the nerve tissue and, finally, complete skeletonization of the glia system. Six cases resulted in intra-ocular tumors, two in phthisis bulbi after injury from the splinter from a shell and one in phthisis bulbi after tuberculous iridocyclitis. In one case of tumor, the possibility of increase of tension was admitted, otherwise not. The summary is as follows:

The cases of lacunar degeneration of the optic nerve are determined by the pathologic processes in the eyeball. It seems that most of this type of degeneration can be traced back to increase in tension.

But the formation of vacuoles in intrabulbar processes is possible in those cases which do not occur with increase in tension, in cases of iridocyclitis and tumors.

Since the pathologic changes terminate in destruction of the ganglion cells of the retina, the vacuolar changes in the optic nerve are always dependent on the eyeball itself. Therefore, there is no genuine vacuolar disease of the optic nerve.

Demonstration Meeting, 3 P. M., Aug. 6, 1928

HERR SALZMANN, Chairman

DEMONSTRATION. DR. VON WASIELEWSKI, Rostock.

Photographs were shown of the living vaccinated and variolated cornea of a rabbit in the stereograph, as well as microstereographic pictures of the teased epithelium of the cornea. Dr. von Wasielewski's co-worker, Dr. Sorgenfrei, carried out the technical part of the work with apparatus manufactured by the

firms of Zeiss, Leitz and Wurach. He further demonstrated the phenomena of luminescence which can be produced by the Jaenicke lamp of the German Tonzeug Works at Charlottenburg. These latter results afford great improvement in the microbiologic diagnosis of smallpox.

ROENTGEN TREATMENT OF EXTRA-OCULAR TUBERCULOSIS. DR. STOCK, Tübingen.

Stock showed three patients with tuberculosis who were partly cured and partly favorably influenced by roentgen treatment.

CASE 1.—A man, aged 53, had tumors as large as a bean under the upper and lower lid of the right eye. The conjunctiva was normal. A tumor was removed by operation; it was typically tuberculous. On irradiation with a 20 per cent unit skin dose, the tumor of the upper lid healed after four weeks without a scar.

CASE 2.—A boy, aged 18, had a solitary tubercle of the choroid. After enucleation the eye split, and after fourteen days a severe case of orbital tuberculosis appeared. After one treatment by irradiation with a 20 per cent unit skin dose, the process healed in six weeks.

CASE 3.—The patient presented a bilateral diffuse swelling of the conjunctiva. A test excision revealed tuberculosis. A year of treatment under various physicians served only to aggravate the condition. Three weeks after irradiation, the patient could open his eyes, and felt well. The swelling had not yet entirely disappeared, the patient was still under observation at the time of presentation. Dr. Stock was of the opinion that the patient would be cured.

ILLUSTRATION OF RETINAL TEARS CLOSED BY OPERATION. DR. J. GONIN, Lausanne.

The speaker showed drawings of detachment of the retina before and after operative closing of the retinal tear. 1. The simplest and most typical cases are those with a tear in which complete cure can be produced by puncture with hot needles; a great number of such cases can be found. The speaker, however, gave only two examples. 2. Two small tears were closed by a single operation scar. 3 and 4. Cicatrization was performed on a medium sized tear after two punctures with hot needles. 5. Cicatrization was performed on a larger tear after three such punctures. 6. Three retinal tears in one and the same case were closed, one after the other, and were completely and permanently healed.

METASTATIC MYOSITIS OF THE EXTERNAL MUSCULATURE OF THE EYE. DR. E. ENGELKING, Freiburg i. Br.

Two cases of metasatic myositis of the external musculature of the eye and the lacrimal glands were demonstrated.

CASE 1.—The patient presented paresis of the left abducens muscle and then the appearance of exophthalmus and swelling in the region of the lacrimal glands. The neighboring organs of the orbit and accessory sinuses were intact.

An operation was performed according to the technic of Krönlein. Pus was found in the lacrimal fossa. Bacteriologic examination revealed *Staphylococcus pyogenes aureus*. The infiltrated portion of the lacrimal gland was removed and the orbit was drained.

Cure resulted, but there was unusually long injury to the function of the abducens muscle.

In this case, the condition must have been independent myositis with subsequent inflammation and abscess formation. The starting point of the infection was unknown.

Case 2.—The patient presented sagittal protrusion of the eyeball on the right side and an unusually high degree of injury to the function of the muscles of the eye, but with complete function of the optic and the ciliary nerves.

There was unilateral dacyro-adenitis which recurred several times in the course of the disease. Chronic recurring tonsillitis was present also.

Operation showed an acute dacyro-adenitis without abscess formation; the (later) opening of the orbit in the region of the abducens muscle and examination of the muscle and the surrounding orbital tissue revealed swelling and redness only of the muscles and the neighboring territory. The remaining orbital tissue was intact as far as could be discerned.

After healing, as in the first case, there remained an unusually long obstruction in the movement of the eye — indeed, an almost complete paresis of the superior rectus appeared, although the inflammation phenomena in the region of the wound healed. During the whole course of the disease, there was a high degree of disproportion between the severe injury to the functioning of the muscles of the eye and the few pathologic changes in the orbital region, indicating that here too an independent formation of metastases must have taken place, apparently through the tonsils.

Demonstrations. Dr. A. von Szily, Munster i. W.

(*a*) Congenital familial "circular cataract." (A full report is published in Klin. Monatschr. f. Augenh., August-September, 1928, p. 145.)

(*b*) Introduction of new models for investigation and instruction. In answer to numerous requests, von Szily had completed some of his flat reconstruction models from the department of normal developmental history and the teaching of malformation in the atelier for scientific sculpture of Dr. Friedrich Ziegler in Freiburg i. Br., and he will be able to obtain them from there. Two series are now in existence, and others will follow at need. The first series (three models) shows the most important stages of development of the "papilla nervi optici primitivas, epithelialis." The second series (five models) shows the various forms and stages of coloboma and of microphthalmus with an without retinal cysts, and aberration of the fibers of the optic nerve. In cases in which it is difficult to make a clear picture of the complicated morphologic relations which are the basis of the portrayal of the developmental history, these models should be of assistance for self-study and for instruction.

Demonstration. Dr. P. A. Jaensch, Breslau.

Photographs and roentgenograms were shown of a boy, aged 15, who was suffering from congenital hydrophthalmus and posterior encephalocele of the right orbit, which led to paresis of the right levator (especially the superior rectus) and the lateral rectus. He pointed out the significance of the concurrence of hydrophthalmus with a real arrest of development as is illustrated by the posterior encephalocele.

Demonstrations of the New Cobalt Lamp. Dr. Kössler, Bozen.

A year ago, I showed you the first model of the cobalt lamp which was intended for use in the chromatic investigation of astigmatism of the eye. This lamp had various faults so that its use was not entirely unobjectionable.

The new lamp is of the same type as that shown before, with a diaphragm opening of 8 mm. out of a distance of 2.5 meters in a darkened space; however, the light relations are graduated more satisfactorily, the radiating slits of light

are larger and less intense and the violet filter is so chosen after long experimentation that the red and blue impressions retain their balance with the use of a 100 candle lamp. Only rays of from 425 to 475 microns and from 650 to 750 microns penetrate; all intermediary rays are extinguished.

Along with the sensitivity curve of rays of different wave length as the Illuminating Engineering Society uses it, it is seen that the rays used opposite the median rays only show a fraction of the clearness.

In order to secure a positive clearness of image, a strong source of light must be chosen and the removal of wandering rays must be exact.

Now a relative enlargement of the red image shows a more hypermetropic presentation of the retina, and the reverse is true: the blue image shows a more myopic one.

Astigmatism shows the recognized cross of red and blue beams when the retina lies in the interfocal space; it is easy to secure this, and in this way the red beams show the location of the light by refractive axis, the degree of which can be exactly presented and read with the help of radiating slit rays.

Asymmetry will be discovered in this way: The dispersion images will be eccentric; they will be broader in one direction than in the other; there will be a decentration in the displacement of the red image against the blue which will be in accordance with a displacement of the lens upward toward a phenomenon caused by light in which the upper edge is red and the lower one blue.

One may believe theoretically that the retina when it is presented in the middle of the red and the blue has a large circle of dispersion and should be placed at a distance from the cobalt lamp. This, however, is not true. In spite of the fact that I investigated in a distance of less than 3 meters so placed that a light blue halo was seen about the bright red disk, thus slightly myopic, for the reading test I had to add regularly plus 0.5 spheric diopters in 6 meters distance in order to get the best visual acuity.

The subjective decision is formed simply, if one goes ahead systematically, first to locate the astigmation through the cylinder, taking care to look through the middle of the glass.

Colored Findings in the Background of a Dead Eye. Dr. Nordenson, Upsala.

The postmortem changes of the retina can be observed with autochromoplates of light.

Apparatus for the Optic Registration of Vestibular Movements of the Eye. Dr. Dohlmann, Upsala.

A little gum nursing nipple in which a small mirror was fastened was placed in the eyeball. The movements of the mirror were photographically registered.

Technical and Clinical Demonstrations. Dr. Wessely, Munich.

(*a*) Stereoscopic photographs of the background of the eye. The excellent Nordenson camera has not yet equipment for simultaneous double observations and ought to be employed only after some rather great technical difficulties are overcome. A special stereoscopic camera is necessary, however. Sometimes the smallest mistakes in focusing in free fixation are enough to obtain an extensive stereoscopic effect through two intended photographs, one behind the other. Much more certain results can be obtained by the use of a small constructed alternate fixation apparatus which can be fastened on the central

pipe of the Nordenson apparatus and is to be placed under the control of the ocular of observation, so that by directing the vision to a green or a red point of light the ophthalmoscopic image is shifted about two thirds of the width of the papilla to the crossed threads of quartz. In this way, reliable clear stereoscopic results can be obtained.

(*b*) Kinematographic: results of operation on the eye in the mirror. Kinematographic results of operation on the eye meet the difficulty that the image of the eye in the photographic apparatus which is hanging down from the cover appears in too reduced form. To improve this condition and in order that the patient be as little disturbed as possible, the speaker has the photograph made by means of a mirror, placed obliquely, which is brought near and somewhat above the patient, while an electrically working kinematographic apparatus stands behind the head of the operating table. The image of the eye being operated on and the whole process of operation appear in the photograph, seen nearly in the same direction as they appear to the patient, only the end of the film must be interchanged to the right and the left. The mirror is placed on an iron support hanging from the roof of the operating room, which at the same time holds a circle of Zeiss lamps for sufficient illumination of the field of operation. The projected photograph shows the arrangement; the test film shows the effect.

(*c*) Relationship of changes in retinal vessels and retinal hemorrhages in hypertonia. The following is a synopsis of investigations made by Dr. and Mrs. Lange at the Romberg Clinic and the Ophthalmologic Clinic in Munich. Through a series of functional examinations, an eventual separation of the various hypertonic diseases, especially a distinction of essential hypertonia from arteriosclerosis, was attempted. Detailed clinical investigation was made with functional tests, such as determination of the time of flowing in and out in the capillaries of the finger under various conditions, measure of rise in blood pressure with removal of the extremities and examination of the reaction following cooling or heating the skin — all material concerning the medicinal and ophthalmologic clinic. Of sixty patients with spontaneous retinal hemorrhages, all but three showed hypertonia. Of these fifty-seven, fifteen had pure hypertonia and forty-two had hypertonia in addition to arteriosclerosis. Retinal hemorrhages are essentially related to high pressure no matter how it originates, and they are not rare in cases of pure essential hypertonia. The same thing is true of the fine but well developed differences in caliber and thickening of the walls of the retinal arteries so well seen with the upright image. On the papilla and near it, these vessels present a gnarled appearance of uneven caliber and an increased reflex, and compress the veins where they cross. Here, too, of forty-seven patients, only four were without hypertonia, twenty-one were suffering from pure hypertonia and twenty-two from hypertonia with arteriosclerosis. The vessels photographed occur in the familiar form of premature hypertonia and can often lead to its diagnosis. The observation, therefore, can change in a single case. The results of these investigations are doubly significant in the question of origin and clinical estimation of retinal hemorrhage, and in the determination of hypertonia as a more or less general functional disease of the vessels.

(*d*) Pictures and preparations of malign progressive melanosis of the conjunctiva. In a woman, aged 78, an increasing dark coloration of the conjunctiva of the left eye developed in the twelve years before presentation. In the beginning, the development was only a surface-like progressive melanosis; then, in the course of the last few years, a large melanotic tumor of the lower lid developed. Since the affected eye was the only one capable of vision, radical operation was

out of the question. In order to obtain more effective roentgen treatment, the tumor under the lid was removed subcutaneously in great part, and a surface-like piece was taken out of the conjunctiva. Preparations of the latter showed the well known forms of nevus cells, irregular arrangement of the pigment in the deeper layers of the epithelium, dropping of those cells out of their connection and development in the thickened connective tissue of an epithelial glandular sheath rich in goblet cells similar to what the speaker showed in his investigation of the subconjunctival injection of a saturated solution of scarlet red in olive oil. This relation between simultaneous changes in the epithelium and in the subepithelial tissue supports the conception that melanotic tumor of the lower lid partly shows the structure of a spindle cell sarcoma, and partly that of a melanosarcoma. In his discussion of the ectodermal or mesodermal origin of the nevi, the speaker said it was a case of interdigitating changes in both layers.

Disturbances of Circulation in the Retina in a Case of Polycythemia. Dr. Mylius, Hamburg.

The patient presented a severe case of polycythemia megalosplenica with an erythrocyte count as high as 15,000,000. There were fluctuating visual disturbances, especially darkening, with complete stoppage of circulation, and destruction of the blood column in the constricted veins, without retinal edema. After some hours, the regular circulation of the blood commenced once more; Uhthoff's sign was present in the various observations.

The cause apparently was a spastic process, and not an embolic, thromboid or terminal arterial process.

Pathologic Changes in the Region of the Anterior Ciliary Vessels in Glaucoma (Observation by Slit Lamp). Dr. Thiel, Berlin.

The emissary vein of the sclera is from twice to three times larger. The ciliary artery no longer fills the cavity. It is broken either just on the edge of the emissary vein or runs parallel to it. The conjunctiva over the emissary vein often becomes hemispherically inflated into a small circumscribed cyst. Frequently, dark brown pigmentation is found near the inner wall of this cyst. Pigment lies further in the subconjunctival tissue like a fine margin near the ciliary artery. The changes are evidently conditioned by the increased intra-ocular tension caused by glaucoma. The tension gradually enlarges the emissary vein and causes the baggy protrusion of the pliable conjunctiva over it. Aqueous and iridic pigment can flow through the enlarged vein. The cystic enlargement of the conjunctiva is considered valuable as protection against too high tension in the interior of the eye; it is found not only in cases of absolute glaucoma, but in cases in which an absolute decompensation is shown by means of tolerance tests. Dr. Thiel recommends that such changes be looked for; since they can aid in the early diagnosis of glaucoma when other clinical symptoms have not yet manifested themselves.

A. Special Subconjunctival Nematode of the Eye. Dr. Pascheff, Sofia.

A charcoal worker, aged 47, four months previously had noticed a small tumor near the outer wall of the eyeball. The eye became inflamed, and he felt slight pain. This lasted three days, after which the tumor developed and did not disappear.

The tumor was excised and examined histologically.

A special type of nematode was found and examined in Königsberg, London, Paris and Hamburg.

Prof. Leiper of the School of Hygiene and Tropical Medicine, London, found the epithelium of the parasite somewhat thicker than that of *Filaria*. He could not make an exact diagnosis. It might be immature ascaris with abnormal structure.

Professor Fülleborn of the Hamburg Institute of Tropical Diseases believed that the case was one of *Filaria* of the conjunctiva.

When cut, the parasite was found to be 0.35 mm. long and 0.243 mm. wide.

B. Transitory Stellate Retinitis.

A school girl, aged 8 years, presented a distinct formation of stars from numerous fine white faint points and streaks in the region of the macula. Near the periphery of the right macula, a small faint opacity in the shape of a horseshoe could be seen.

The foveola reflex of the left macula was not entirely clear. Vision in the right eye was 6/30; in the left, 6/50. The patient did not know the alphabet. Perimetry revealed central scotoma, especially for the colors. The field of vision was somewhat restricted.

There was no sign of nephritis (Prof. Wateff).

The blood pressure (by the Riva Rocci sphygmomanometer) was systolic 96, diastolic 58. The Wassermann reaction was negative. The rhinologic examination gave negative results.

The patient was under observation in the clinic for a month. Internally, she was given iodotannic syrup. Her food consisted of vegetables.

The striped arrangement of the macular opacity in both eyes almost disappeared. In the right macula, a trace of a horseshoe-like infiltration could still be seen. In the left macula, the whitish point and streaklike opacities were still visible in the lower and outer portions of the macula. The vision for both eye was 6/6. The field of vision was normal.

From the various diseases of the macula (Pascheff, Sofia: Recherches sur le pathologie de l'appareil maculaire, 1927), a diagnosis was made of transitory stellate retinitis.

C. Follicle Formation on the Cornea with Spring Catarrh.

Blindness after spring catarrh occurs rarely, even in the practice of those of us who have seen many cases of this peculiar disease of the conjunctiva. In the last twenty-eight years, I have seen four such cases. The last one deserves our greatest consideration.

A farmer's son, aged 12, said that two years before presentation his eyes became inflamed and teary, and avoided the light. In time, his visual capacity was so decreased that he could hardly see this own hands.

The tarsal conjunctiva was somewhat thickened, wine-red, dim and uneven, but without distinct papilla. The bulbar conjunctiva was crossed by enlarged veins. The cornea, especially of the left eye, was covered with an uneven tumorous thickening, with a nodular surface. The thickening was greatest in the periphery of the cornea, where it became ring-shaped and then thinner toward the corneal center, in a crater shape. In the center, the cornea was opaque, gray and crossed by thick, enlarged vessels.

The peripheral thickening was somewhat gray, more nodular in form, hard at touch and poor in vessels on the surface.

The inner portion of the eye was opaque.

The patient could see only the movement of the hand before the eyes.

The patient was thoroughly examined. Examination revealed a weak lymphatic constitution with well developed adenoid vegetation in the nasopharynx. Examination of the blood showed lymphocytosis.

The tumorous thickenings of the cornea were excised. Histologic examination disclosed: papillary thickening of the epithelium, extensive proliferation of the adventitious and connective tissue and formation of new vessels and lymphocytic infiltration, with the formation of real germinating centers. Plasma cells, eospinophil cells and mast cells were seen in the epithelium.

After operation, sight improved in time: right eye, 3/50; left eye, 2/50.

April 1, 1927: The eyes had again become red and teary, and avoided the light. The scleral conjunctiva was greatly congested, especially in the corneal region of both eyes. Thickenings were formed again on the cornea.

July 1, 1927: The thickening on the left cornea and the nodular thickening of the bulbar conjunctiva were excised. Histologic examination of the corneal thickening revealed the same structure, with the exception of the connective tissue. The latter was much more proliferated, with hyaline degeneration. The nodular thickening revealed thickening of the epithelium, neoformation of vessels, great lymphocytic infiltration and germ centers at the base. Many eosinophil, plasma and mast cells were visible.

March 10, 1928: There was another recurrence. New fibrous nodular thickenings were formed on the cornea. A new phlyctenular thickening was formed on the bulbar conjunctiva of the left eye.

This remarkable case was interesting for several reasons: (1) the localization of processes in the cornea; (2) the slight visual capacity; (3) the presence of follicles (germ centers) in the neoform tissue on the cornea; (4) the regular recurrences each spring, and (5) the general lymphocytosis.

The interesting phenomenon was the newly formed tissue on the cornea. If this phenomenon is compared with that of trachoma it is seen that the first is harder and fibrous, infiltrated with lymphocytes which sometimes form germ centers and rich in eosinophils; in trachoma, the tissue is softer and formed of numerous follicles which often become fused.

Both, however, develop on the cornea, penetrate Bowman's membrane, are usualy found in young persons, recur often and are accompanied by lymphocytosis.

Such an analogy is found in the nasopharynx where fibrous formations appear near the follicular adenoid proliferations.

NEW STEREOSCOPIC PICTURES FOR CHILDREN WHO SQUINT. DR. C. H. SATTLER, Königsberg i. Pr.

This article is published in full in *Klin. Monatsbl. f. Augenh.*, 1928, p. 182.

DEMONSTRATIONS OF A SIMPLIFIED APPARATUS FOR REFLECTOGRAPHY. DR. F. P. FISCHER, Leipzig.

In last year's demonstration meeting, I had made some simplifications in the previously shown apparatus for reflex photography; these facilitate the accommodation and manipulation of the apparatus, reduce the price and make possible reflex photography as well as simple visual methods in clinical operations, as is done in more complicated photography. In contrast to the first model (demonstration), which was mounted on a heavy, transportable, expensive stand, the new apparatus stands on two small feet; this was made possible by the construction of a Leitz liliput arc lamp in the interior. You will recognize the simplification and reduction in size which is thus brought about. The liliput arc lamp is placed in a

light-tight enclosure through which a blind is placed in the lower part, opposite it on a prismatic shaft of the lens system which makes the light parallel; a removable water pan is included. The enclosure with a blind for the field of vision fits into a light rod which ends before the frame of the drying box which holds the screen. The screen, chin support and contrivance for measuring are unchanged. In this model without an instantaneous shutter, the contrivance allows for the visual study of reflex images. In clinical usage and in examination of the cornea in general practice, the study of reflex images before the examination by slit lamp aids in the location and prevention of activity in the cornea. Examination by slit lamp may miss minute changes because of their smallness and location. Portrayal of the reflex image not only shows unobserved changes in the surface, but it aids in finding small changes by slit lamp. Examination with the slit lamp following the reflex image examination can easily disclose small changes. The simplest apparatus can be used in photography of the reflex image if the light rod is replaced by a shorter rod which is shaped into a cylindric box at one end, and contains the instantaneous shutter with the pendulum apparatus shown in the sketch (demonstration). In the table on which the apparatus is set, a section must be made, can swing in the pendulum or be put on two small tables. The manufacturers offer the apparatus with or without the instantaneous shutter (H. Diel, Leipzig, Albertstrasse 28). It can also be procured as visual or photographic apparatus which can be adapted to both purposes as has been described.

PECULIAR RELATIONSHIPS IN THE REGION OF STAEHLI'S LINE. DR. COMBERG, Berlin.

Near Staehli's line, connected with it or in its neighborhood, occasional lines of pigment can be found in spiral forms. Comberg made his first observation in 1922; he saw a Staehli line which ended in a spiral form. In another case, he found a double spiral form starting from a Staehli line. In a third case, he observed for a year a patient who had superficial keratitis; he found near two spots of keratitis two small spiral lines which united in the middle. After three months, another line began from the point of union; this terminated in a dendritic branching as was formerly found only in nerve fibers. Simultaneously this pure epithelial branching (slit lamp) could be seen crossing the beginning of a Staehli line. After six months, one of the spots and the spiral line connected with it disappeared; at the last observation, a fine double line extended from the everpresent second spot. The number of branchings had further decreased; the horizontal pigmented epithelial opacity corresponding to the Staehli line had become clear. The development of a Staehli line could be observed, and pathologic changes in the neighborhood were going on. It is probable that similar processes are frequently connected with this development.

A TRANSPARENT BANDAGE OF ZELLON. DR. METZGER, Frankfurt a. M.

To replace the figure of eight bandage which, aside from its advantages, shows several difficulties in adjustment, fastening and fragility, clear Zellon rolls from 0.2 to 0.6 mm. thick have been tried out. The material is clear glass, unbreakable, pliable, water-tight and fireproof. It can be easily and trimly cut with any bandage scissors of the usual size. Through a section on the temporal margin which is directed about 2.5 cm. toward the middle of the disk, a hollow transparent flap is formed when the edges of the cut have been put together. The pliability of the material permits another improvement to be introduced by bending the lower nasal edge; on the inside, a groove 0.5 cm. wide is formed, so that penetration

of lacrimal fluid or secretions between the plaster and the skin is prevented. The fastening is made with two strips of adhesive plaster which extend along the edges of the film from the root of the nose to the cheek. For practical use, the rectangular form is considered best in the 6 by 9 size.

A Stereoscopic Hand Ophthalmoscope Without Reflex. Dr. W. Thorner, Berlin.

Thorner combined the principle of his monocular hand ophthalmoscope, which casts the image of the background of the eye by means of a concave mirror, with a stereoscopic opening through which both pupils of the observer are formed at sufficient distance within the dilated pupil of the patient. The resulting image shows a linear increase sixteen times as large, and an outline as large as if it were seen from a distance of 20 cm.; with the help of a probe, it is as easy to focus as the image of Thorner's monocular ophthalmoscope. The instrument differs from other ophthalmoscopes in that it does away with reflexes and films, and can be used as a hand ophthalmoscope and at the sick bed. The apparatus is manufactured by Emil Busch in Rathenow.

Scientific Meeting, Aug. 7, 1928

Dr. van der Hoeve, *Chairman*

Developmental Historical Conception of the Conditions of Refraction of the Eye. Dr. Scheerer, Tübingen.

Of 12,000 eyes of people over 25 years old, of all stations and without astigmatism, a refraction curve was made which shows the well known spread and irregularity of the myopic curve. If we remove from this curve all cases of changes in the background of the eye (crescents, localized changes, staphyloma), the result is a binomial; that is, a symmetrical curve which extends from about +10 to −9 diopters. The most frequent value of the axis of symmetry lies in +0.5 diopters. There is correspondence of +1 and emmetropia, +2 and −1, etc. The success of the curve is shown in light images; the exact arithmetical elaboration will be given soon in another place. Cases of change in the background appear in the terminal curve in low degrees of hyperopia with 1 per cent; their frequency increases regularly and reaches to about −12 diopters, 100 per cent. These cases form a curve between themselves, the greatest part of which extends to −5 diopters in emmetropia. The curve contains all forms of changes in the background, which will be isolated later. Most of the changes are considered malformations in the region of the papilla, especially in the higher degrees, in which cushion-like formations and pouches are found in the territory of the coloboma; of lower grade forms, at least the so-called coni in heterotypic direction. On the other hand, the possibility of the origin of certain changes by stretching cannot be shown on the basis of the material at hand; in the first line, this is shown in certain secondary changes of severe cases; perhaps, too, certain cases with smaller crescents. The human curve of refraction originates out of the overlapping of two curves: The one represents all eyes free from changes and exhibits a binomial course, a pure variability curve made of corneal refraction and length of axis also being shown; the other curve represents all eyes with changes of the background which, therefore, do not belong in the pure curve of refraction as abnormalities of any kind. Essentially, the congenital nature of changes of the background is sometimes ascertained and sometimes apparent.

ANATOMIC AND EXPERIMENTAL EXAMINATIONS OF THE MECHANICAL FACTORS IN ORIGIN OF MYOPIA. DR. W. COMBERG, Berlin.

The most important progress in the investigation of myopia in the last twenty years rests on the proof of the great significance of inheritance in the adjustment of refraction. Pure physiologic variation in growth cannot be the cause of the frequently occurring pathologic changes and the early foci of degeneration. Numerous analogies (for example, flatfoot and pulmonary emphysema) corroborate the fact that important tendencies in connection with mechanical factors condition the myopic structure of the eyeball.

As for the small space of modification, which was measured to be 2.5 diopters by Jablonski in twins produced from a single ovum, essentially only the mechanical factors are taken into consideration, which in the course of daily life operate in about the same way in all persons. The standpoint taken here is the only one possible according to the nature of the results of modern investigation, which can take into consideration the operation of mechanical factors.

Comberg's investigations reveal two factors which act much in the same way in all people and can finally exert a mechanical influence in the posterior pole in the sense of dilatation. The first is the vibration of the optic nerve because of the resistance of the cushion of fat and the underlying recti with lateral visual movements. That this factor causes vibration not only of the optic nerve, but of the eyeball and the retina which is adjacent to the optic nerve, can be shown in well known investigations which are given over to making the blind spot visible. That the anatomic relations present certain necessary assumptions can be demonstrated by Comberg in color photographs which were made after the removal of the upper orbital sac and upper orbital contents of a corpse with the eye in various positions. The second factor which acts in the same sense is the backward shifting of the eyeball in the orbit at the opening and closing of the lids, like the slight push backward at the opening and closing of the lids on blinking. The amount of the push could be measured by Comberg; the spring tension, through which the push at blinking was intercepted in the apparatus used for the purpose, corresponded to an average weight of from 15 to 16 Gm.; in full opening and closing of the eyes without twitching, it corresponded to from 35 to 40 Gm. Since the eyeball only weighs 8 Gm.; the blinking is easily influenced in the posterior portion which can take effect as contrecoup in the posterior pole and as a jerk in the optic nerve and in the adjacent portion of the eyeball. The relationships can be proved also in entoptic experiments, for at blinking or opening and closing of the eyes the region of the entrance of the optic nerve can be seen to light up particularly in lateral direction of vision.

Gravity, according to Levinsohn, presses the eyeball forward when the head is bent and, through pulling the optic nerve, causes a stretching of the posterior pole of the eye; Comberg can assign no especial significance to this on the basis of his measurements. In numerous examinations of corpses, there was never found in the bending optic nerve a smaller gain in length than 5 mm., and numerous exact measurements of the position of the eyeball in the orbit show with complete certainty that the eyeball extends forward from 1 to 1.5 mm. only in patients lying down; in those who are sitting up, it extends not more than 0.5 mm., and the bending forward of the head has no influence at all. The eyeball can never hang on the optic nerve in the Levinsohnian sense. Different results in experiments with monkeys can be explained by the different anatomy of the eye of a monkey and its entirely unnatural manner of holding the body.

NEW HISTOLOGIC EXPERIMENTS ON EYES OF MONKEYS WHICH WERE MADE SHORT-SIGHTED AND THEIR SIGNIFICANCE IN THE ORIGIN OF MYOPIA. DR. LEVINSOHN, Berlin.

The histologic observations of Essed and Soewarno (*Klin. Monatsbl. f. Augenh.*, vol. 80, p. 56) in the eyes of monkeys made short-sighted which the author demonstrated with fourteen diapositives and eleven drawings show the following results: 1. Attrition of the temporal scleral margin had occurred along the entrance of the optic nerve, with retraction of the lamina elastica and the pigment epithelium, as well as atrophy and complete disappearance of the choroid in this section. 2. Loops of the fibers of the optic nerve had formed in the region of the conus, the tip of which was drawn to the retracted and somewhat inward bent Descemet's membrane. In this place, the lamina elastica, as well as the pigment epithelium, was partially broken off in acute angle form through the taut nerve fibers. 3. Supertraction had occurred in the lamina and the pigment epithelium, which in one place was angularly bent, on the nasal side. 4. There was a partial rise of the temporal ending of the lamina cribrosa and pulling of the ending strips and limiting tissue over the anterior margin of the sclera. 5. There was a severe angular bending of the terminal joints of the rods and cones in the temporal entrance of the optic nerve in such a way that the external parts were directed toward the temporal and the internal parts toward the axis. 6. In monkeys, in which despite retraction of the lamina elastica — pigment epithelium — a conus was not visible; the thickened, strongly pigmented choroid could be determined as reason for the absence of the crescent. 7. In monkeys in which venous hyperemia had been observed during life, slight choked disks could be found.

The observations in the eyes of monkeys agree in their nature with the known histologic observations in myopic eyes of human beings. Its essential significance is this: that the anatomic changes are attained in a short time through a definite arrangement of experiments. The origin of myopia and development of the conus must be conditioned, therefore, by the horizontal position of the eye. Heredity comes into the question of the genesis of myopia only as a determining factor.

DISCUSSION OF PAPERS BY DRS. SCHEERER, COMBERG AND LEVINSOHN

DR. CLAUSEN, Halle a. S.: The results of Herr Scheerer's experiments could perhaps explain in a more certain way the asymmetry of the refraction curve, that is, the uneven myopic curve. The cases of conus might have been taken out as a special group. I do not think it is entirely correct to speak of a congenital conus, since in new-born infants a conus is not usually found. In Halle, I observed 600 new-born infants, who were examined thoroughly for various reasons, and I never found a case of conus.

I would like to make a few suggestions about hereditary conus.

As for Herr Comberg's experiments, I would like to remark that investigation in corpses should not be taken into consideration without further work, for the physiologic tone of the muscles of the eye and the orbital fascia is decreased; in a living patient, the relationships are different. I am not convinced that in healthy eyes the lateral pushing and twitching can cause myopia or conus; the case is different with those eyes which have a hereditary myopic structure. In such cases, all kinds of factors can modify the process leading to myopia.

DR. BEST: Between the curve of short-sightedness and longitudinal growth of the body there is a remarkable analogy. There, too, one finds asymmetry, a steep rise in the curve in short people and a gradual falling off in tall people. There is a pathologic influence contained in the falling portion of the curve, for example, for the degenerative growth in height.

DR. THORNER: Comberg's experiments have especially interested me because they accept as a factor in the origin of myopia that which I showed twenty years ago in the clinical monthly journals. At that time, I studied the various movements of the eye in their flail-like activities and determined that in no activity is there so much claim on the eye as in reading. Reading does not take place by the eye gliding continually along the line, but it moves jerkily, and sometimes shifts its position frequently in quick movements and then sudden stops. If the flail-like movement of the eyes is taken into consideration in the origin of myopia then the old theory is explained that reading exerts a harmful influence.

DR. SCHEERER: That such changes as those which exist in myopic people should be caused by pull on the optic nerve seems highly improbable to me. For instance, I cannot understand why there should be nasal stretching at one time (such cases are rather common) and temporal stretching at another, and how in the last cases the image of inverse implantation of the optic nerve always originates, and can always be observed as a congenital form of papilla. The mechanism of dilatation must have affected these cases in the same way as it did the others — that is, temporally.

The observations in congenital hydrophthalmus, in secondary hydrophthalmus in children and young people and in juvenile glaucoma contradict a stretching under the influence of intra-ocular tension. I will return to this later, and only wish to say now that in juvenile glaucoma and secondary hydrophthalmus the retina tends to end normally at the edge of the papilla, and only the papilla is excavated. The sclera, too, remains normally thick. The few cases in which it is otherwise, must be myopic eyes. In congenital hydrophthalmus, too, one finds a completely normal situation along the margin of the retina. In other not entirely rare cases, one finds inversions of the retinal contents in the form of cushion formations under the pigment epithelium, which could never originate through stretching, but should be considered as they are in many cases of high myopia and certain forms of coloboma, that is, as congenital malformations in the papilla; and if one considers how frequently glaucoma occurs in excessive myopia, this form of hydrophthalmus may then be diagnosed as congenital excessive myopia with intra-uterine onsetting glaucoma.

I have brought along preparations of these various forms and will gladly show them to those who are interested.

The fact that suckling children have no coni contradicts later pathogenesis on the basis of developmental historical factors. The symmetry of biologic curves is all the greater, the more it is a case of simple conditional indications in the method of Valentin Hacker; and the proportionately simple limitation plainly proves correct in the bending of the cornea and the length of the axis in the normal eye. I must admit that I doubt the conclusiveness of Levinsohn's pictures. Just as it is not a case of central implantation of the optic nerve, one finds the so-called temporal fusion in degrees of refraction and can diagnose directly from this "tuck" formation, without having seen the retina (layer of ganglion cells), that it is on the temporal side. If this cannot be done, it is certainly a case of inverse papilla.

DR. COMBERG: In cases without pathologic changes, the characteristic factor is an extraordinary variation in growth, and only in the remaining cases do mechanical factors contribute. They are, however, not only factors like reading and close work but all those which affect the eye thousands of times a day. Perhaps the effect of all these various factors is enhanced by close work. Only the eye which has a high tendency to be myopic can be affected by them. As soon as the harmful influence of eye movements is agreed on, then the distinction statistically ascertained in the various professions (watchmaker, typesetter) can be easily explained.

DR. LEVINSOHN: The asymmetry of the binomial is a positive proof that in the origin of myopia not only factors of inheritance but also those of daily life are involved, and I am glad that Comberg has ranged himself against its connection with muscular tension. When he uses as proof for the incorrectness of my diagnosis the excess of the optic nerve over the linear distance from the posterior pole of the eye to the optic foramen; I would like to recall Leopold Weiss' investigations in which he thoroughly studied this factor, and at the same time showed that in the convergence position the surplus is in most cases equalized so that this force of gravity can no longer affect the eye completely. That the eye is pushed forward greatly in the dorsal position. I determined in my first experiment. It is especially a case of the greater plethora of the orbit. I have also shown that when the patient is lying on his stomach, gravity sends the eye still further downward. When Clausen has found no conus in 600 suckling infants and Scheerer says that a conus can always develop, I can refer to my experiments with children, aged from 4 to 6 years, in whom the behavior of conus almost agrees with the behavior in suckling infants. At the age of 4 years, the eye is almost full grown, so that growth cannot be said to cause the formation of conus. When Scheerer refers to my demonstrated preparations with the remark that the formation of loops of the fibers of the optic nerve also exists normally in the temporal optic nerve, he undervalues the significance of the preparations demonstrated. Such changes as I have shown are never found in dilatation of the normal eye, and the reference to Elschnig's work does not apply, in my opinion. In spite of the worthy objective determination of Elschnig, I believe that the entrances of optic nerve which were described, were for most part not normal, but those which were observed in stretched eyes. Since eyes are more or less generally hypermetropic after birth, it can easily happen that in spite of strong myopization the eye shows an emmetropic or a hypermetropic refraction, but possesses a conus in spite of this. The fact that watchmakers acquire myopia less and typesetters more frequently, I have already explained is due to the fact that watchmakers bend their heads and bodies a little, and typesetters a great deal, in their work. The importance of my investigations consists in this, that from the first I have the support of facts, while all other theories up to this time concerning the mechanical factors in myopia have been built on air.

INFLUENCE OF PSYCHOLOGIC FACTORS ON THE COLOR THRESHOLD OF ANOMALOUS TRICHROMATES. DR. ENGELKING, Freiburg i. Br.

The influence of "form" and "ground" on the color threshold were tested in normal and anomalous trichromates and compared. In three normal, thirteen deuteranomalous and two protanomalous patients, the so-called "ground threshold" was compared to the "form threshold" for red and green. In all cases, the form threshold was higher than the ground threshold; the quotient of both (F/Gr) was greater than 1.

While the quotient in normal patients was about 1.43 for green and 1.4 for red, the quotients in anomalous patients were high; in deuteranomalous patients, for example, they were 2.37 for green and 2.45 for red. Similar conditions existed among the protanomalous patient.

Under the influence of significant forms, the color thresholds of the anomalous patients rose much higher than those of normal patients under the same conditions. The result was that in anomalous patients the result of form relatively prevailed against that of color.

This condition showed a decrease of the color sense of anomalous patients under conditions of practice, and one must recognize that outside the psychologic factors studied, others exist which may injure the color vision; for example, attention and production of form, in the broadest sense. All these factors may disturb the recognition of color in anomalous patients.

Tschermak shows that in testing of the ground threshold and the form threshold, the physiologic relations in the field of examination are not identical. An important distinction exists in dioptric relation (aberration of light in non-stigmatic drawing) as well as in the effect of contrast, according as the field of examination is outlined or not outlined; indeed, it is only important to given outlines distinguished in the field of vision. This complication cannot be removed and should be taken into consideration in experiments on the influence of the determination of form. A similar complication (partial overlapping of the surfaces of aberration in presentation of a great number of neighboring fields) has already led in older experiments to the untenable thesis that the single portions of the field of vision replace each other in even costimulation and can support each other.

DR. ENGELKING: I agree with Tschermak that just as in experiments dealing with color psychology, the psychologic relations must be taken into account, so, on the other hand, in such experiments psychologic considerations must not be forgotten.

It goes without saying that I, in my experiments, noted the sources of error which Tschermak mentioned.

The introduction of this type of experiments in anomalous trichromates because of their special kind of vision requires special arrangement for example, with respect to the size of the fields — which makes it worthwhile for me to show my arrangement. I naturally tried experiments with fields which were not outlined, and proved to myself that the outlines which I had used, which concern only a part of the field and are subtle with respect to the size of the field of color, did not greatly influence the result of my psychologic conclusions.

The result is the same if the outlining of the ground field is made in the same way as that of the form field.

The substantial result of my investigations remains untouched by Tschermak's objections since I did not wish to establish the increased threshold of the form field but to compare the behavior of normal and abnormal trichromates. Essentially, the discrepancy lies in the behavior of these two groups; it is undisputable that this is due to psychologic factors.

THE TONUS VALENCE OF CHROMATIC STIMULATION IN THE OPTOMOTORIC REACTION. DR. METZGER, Frankfort a. M.

I am going to test the optomotoric reaction today for diagnostic purposes with the streak drum (streifentrommel) or a streaked figure (Streifenfigur) on the lemniscus. If this simple figure moves evenly and with a certain rapidity in one direction in the field of vision, optomotoric nystagmus develops in normal patients. The turning force of the object in the field of vision accords with the dilatory component force of this rhythmic nystagmus; as a secondary movement, it has the tendency to hold the retinal image constant up to the limit of the field of vision. If this position is reached, a short twitching of the contradictory turning force appears, which, as the so-called backward leading movement or late reaction, seems to rush from the original position of rest toward the newly arisen irritation. These relationships are valuable for testing with white mixed light. There is shown in the amplitude and frequency of the rhythmically alternating phases a certain dependence on the angular velocity of movement, relatively on

the width of the streaks. The upper and lower thresholds within which the reaction succeeds are related to the speed as well as the intensity of illumination of the subjective perception of the figure and of the completed changes.

My investigations of light tonus have given me cause to compare the effect of lights of different wave length in general tonus processes. Three years ago, I could affirm that the alternation of the chromatic component force for the shifting of the sensomotor equilibrium is almost of greater significance than the simple variation of intensity. As chromatic valence, one finds in tonus circumstances a parallel behavior of spectral lights to the known graduated effects within the spectrum which are described as electromotoric valence (Fröhlich) or pupillomotoric valence (Hess). Opposing a light of medium wave length or a corresponding mixed light, rays of long wave length of the same brightness act; rays of short wave length, on the contrary, strain the tonus on the exactly struck antagonistic function. The jerky character of optomotoric nystagmus can easily be broken up in red light with a tonic gliding movement, in blue light as a clonic jerking movement. A change appears with the exclusive use of a light of long or short wave length opposed to the mixed light, as the alternation between the long and short component forces recedes, and a gliding (red) or jerking (blue) rhythmic nystagmus takes its place.

In the subjective impression of movement, these distinctions are clearly shown. This difference is most striking when alternating complementary colors of the same brightness are used for illumination.

The most important of the physiologic reactions which one can use as an explanation of tonus valence is the difference of latency time as it has already been examined as a subjective phenomenon in experiments with the stereo-time-phenomenon (stereozeitphänomen) (Pulfrich) and has also been investigated from the ophthalmologic side (Engelking). Demonstrations of this chromatic shifting within a field which has been moved succeeds best with the use of illumination intermitting between red and green. As soon as the streak drum moved, a glimmering took place in the object which was standing still; borders of color appeared at the further end which accorded with the short wave component forces, while the slow, sounding, long waved stimulations fringed about the nearer edge of the field. Thus, for the time of shifting within the field stimulated, a chromatic descent is caused, which, by carrying the eye up to the speed of the object, is again paralyzed. With these fleeting differences in effect, still more appear in the optic portrayal of qualified chromatic variations. Accordingly as the differences of physical chromatic aberration encounter harmoniously or contradictorily the division brought about by movement and difference in time, there appears an increased tonus effect or one that is decreased by subtraction. Thus, differences such as are shown in astigmatism in the frequency and amplitude of the optomotoric nystagmus on turning the various axes, can be thoroughly analyzed in isolated monochromatic stimulation.

The excentric portrayal of a parafoveal object of stimulation is stronger in red than in blue. If a blue stimulation appears in the territory of the periphery of the macula, there is moderate dissociation of the color components, in the direction of the periphery of the fovea against the removal of the temporal and local difference. The change in the pupillary distance with the use of varicolored lights may also have a part in the resulting tonus effect through its different effect on the clearness of the margin of the picture. It would be going too far to differentiate still more and to make a closer analysis. Practically, it is valuable to know the fact of tonus valence, at least so far as it is related to the physiology of sensory chromatic stimulations and to the chromatic variations which until

now were thought to be optic defects, in order to find actual permanent conditions of pathologic forms of eye vibration.

In closing, I would like to say that knowledge of the chromatic tonus valence is perhaps qualified to test from a new point of view the presentations of Herr Ohm on the harmonious analysis of the curve of nystagmus. If Ohm had tried to explain the rhythmic action of the muscles of the eye from the alternation phases of two oscillations of the pendulum, it would bring to mind the thought that this may be seen in the alternation of long and short wave stimulation.

THE COURSE OF DARK ADAPTATION AFTER PREVIOUS BRIGHT ADAPTATION IN VARIOUS SPECTRAL LIGHTS. DR. GASTEIGER, Innsbruck.

Gasteiger investigated the course of dark adaptation after previous bright adaptation in various spectral lights of the same intensity. After bright adaptation for twenty minutes in red, orange, green and blue light, the course of dark adaptation was studied in ten normal people. The result was that after previous bright adaptation in long wave light, small stimulations sufficed for the arousal of sensitiveness in dark adaptation, as was the case after the adaptation of short wave light. On the other hand, the sensitivity rose higher in the last case than in the first. At the latest, after forty-two minutes the same amount was reached in the same person, and thus every influence of the previous bright adaptation was removed. From these results, the conclusion is drawn that the spectral synthesis of the light used to bright adaptation has an influence on the course of dark adaptation. The capability of dark adaptation to be influenced by bright adaptation with varicolored lights seems to suggest that the retinal cones are of significance in the process of adaptation and the process is related to the retinal elements.

MOVEMENT OF THE AQUEOUS HUMOR IN THE EYE. DR. E. HERTEL, Leipzig.

Experiments were reported in which the ingoing and outgoing of the aqueous could be determined in the unopened eyeball and measurements made to a certain degree, and information was obtained on the passage of the aqueous. As in his experiments with the influence of the concentration of the blood on tension in the eye (*Arch. f. Ophth.*, vol. 88), the aqueous was taken out of the eye by suction through intravenously applied salt and gelatin solutions. Weighing gives information about the relation between the lowering of tension in the eye and the going off of aqueous from the eye, as well as the amount which returns after restoration of the tension. Further experiments with animals in which the aqueous was colored by intravenous treatment with fluorescein and eosin, showed that the passage of the aqueous and the color material (fluorescein and eosin) is the same from the blood vessels to the eyeball as from the eyeball to the blood vessels. Exact study of the eye which is colored showed that the vessels of the iris and the ciliary body were dyed but not the ciliary epithelium, from which fact it is determined that the latter is impermeable to color material and aqueous. The flowing of the aqueous in and out of the vessels follows the laws of osmotic interchange of liquids.

COMPARATIVE MEASUREMENTS OF THE ELECTROLYTE CONTENT OF SERUM, ULTRAFILTRATION OF SERUM AND AQUEOUS. DR. BAURMANN, Göttingen.

With the customary micromethods used in parallel determinations of the ionic content of serum, ultrafiltration of serum and aqueous, the following results were reached: The potassium content is higher in serums and ultrafiltration of serum

than in aqueous. It can be shown that this excess is due to a secondary escape of potassium from the erythrocytes. The excess of potassium in the blood disappears when the blood is taken up, with exclusion of paraffin, and immediately centrifugated.

There is much more calcium in serum than in aqueous or ultrafiltration of serum. Aqueous and ultrafiltration of serum agree with each other. Serum also contains a great amount of calcium which is not ultrafiltrable.

Determinations of chlorine were made in rabbits with the consideration that an escape of chlorine between serum and erythrocytes takes place in dependence on the hydrogen ion concentration; the blood was taken up with exclusion of air.

A comparison of the phosphorus content of the ultrafiltration of serum and the aqueous shows somewhat more phosphorus in the aqueous. The excess in the aqueous seems to be due to organically combined phosphorus, corresponding to the fact that the albumin content was greater in the aqueous than in the ultrafiltration of the serum.

The slight difference which remains in the determination of sodium, potassium, calcium and chlorine in the ultrafiltration of serum and the aqueous is due to the fact that the ultrafilters are thick with albumin and hold back traces of electrolytes in rapid ultrafiltration.

THE PROCESS OF AQUEOUS FORMATION. DR. H. SERR, Heidelberg.

The use of colloid-chemical methods and the results of investigations are necessary for the knowledge of aqueous formation. On the other hand, a great deal of confusion was brought into the problem by physicochemical consideration which is beside the point or one-sided and in which anatomic, physiologic and clinical points of view must be taken into consideration also.

In the process of the continual replacement of aqueous, the important thing to be explained is the flowing of the liquid out of the blood vessel into the chambers of the eye. Such a movement of humor out of the blood vessels through the capillary walls into the tissue and into the inner eye can be caused by physicochemical and vital forces.

Regarding the physicochemical forces, there are two possibilities: 1. The first is the filtration or ultrafiltration, respectively, in the presence of a corresponding hydrostatic distinction of pressure between the intra-ocular capillaries and the chambers of the eye. In the physiologic formation of aqueous, the preliminary condition of a process of ultrafiltration with regard to the colloid osmotic pressure of the blood over against that of the aqueous can be given only if it can be shown that the blood pressure in the capillaries of the ciliary body is over 55 mm. of mercury. This preliminary condition is not fulfilled according to measurement of the blood pressure in the anterior ciliary arteries. 2. The second is a movement of fluid conditioned by osmotic force which should take place with the predominance of the osmotic pressure in the aqueous over against that of the blood. This possibility is also discounted, since not the aqueous but the blood shows a higher osmotic pressure.

Other physicochemical processes as regards the movement of liquid in the animal body are out of the question, especially the occasional falsely used conceptions of diffusion and dialysis, which processes can only explain a salt or ion distribution in liquids already existent.

One must, therefore, consider vital forces in the continual formation of new aqueous from the blood; that is, a kind of secretion in which the cells of secretion in comparison to the real gland cells, have only a relatively simple, purely physical work to perform, while the second chemical process in the real gland cells (synthesis of products foreign to the blood) ceases here.

Other factors beside the results of measurement of the blood pressure uphold this view: The unpigmented ciliary epithelium possesses a complicated cellular structure which resembles real gland cells and also greatly resembles the figures in the choroid plexus. Further arguments in favor of this view are the consumption of oxygen (oxydase reaction), the results of the vital coloration and the proof of characteristic electric potential differences, so that the ciliary epithelium is to be considered the "gland of aqueous humor."

The slight excess of negatively charged chlorine ions in the aqueous is of secondary nature in comparison to the condition in the blood. It must be established for physical reasons during the long detention of the newly formed aqueous in chambers of the eye, even if the composition of the aqueous should be somewhat different at the time of its entrance into the inner eye.

From the clinical standpoint, the lowered tension with dilated pupil which comes after intensive use of epinephrine as a late effect in the healthy and glaucomatous eye and the severe hyperemia of the intra-ocular vessels cannot be explained without the presence of secretory formation of aqueous. This reversible lowering of the tension in the eye is to be considered as the poisonous narcotic effect of epinephrine on the ciliary epithelium, the vitality of which is injured, and the secretory function is shown. This is clearly shown in those glaucomatous eyes in which each mydriasis (by shading) leads to a considerable increase in tension by displacement of the angle of the chamber which is absent for some days after the use of epinephrine, in spite of corresponding mydriasis.

The known experiments in India ink of Nuel and Benoit on the human eye are completely understandable through knowledge of the secretory formation of new aqueous.

There is no doubt today that the continual replacement of the aqueous follows a course which can be designated as primitive secretion.

The Blood and Aqueous Barriers in Their Relation to Autonomous Innervation of the Eye, Especially to the Sympathetic Nerve. Dr. F. Poos, Münster i. W.

In order to obtain quantitative proof of the passing of pharmacologically active substances into the aqueous, with a relative barrier raised between the blood and the humor of the eye, with respect to the deficient function of condensation of the sympathetic nerve, comparisons were made of the pupillomotoric effectiveness of atropine, scopolamine, homatropine, eserine, pilocarpine, epinephrine, ephedrine, cocaine and ergotin in rabbits in which the cervical ganglions were unilaterally removed. In a second series of experiments, the difference in concentration of the aqueous in poisonous material (scopolamine in the aqueous on both sides), the sympathetic paralyzed side was more strongly effective mydriatically in the enucleated eyeball of a frog than the normal side. A stimulation threshold can be found for atropine as well as epinephrine; atropine is effective on the sympathetic paralyzed side, but on the normal side.

Experiments with the distinctive effectiveness of various substances before and after degeneration of the sympathetic nerve fibers measured in their pupillomotoric effectiveness with special consideration of temporal relations, as well as experiments with difference in content of scopolamine and epinephrine in the aqueous, lead to the explanation of the accelerated and prolonged effect on the sympathetic paralyzed side by an accelerated and increased passage of substances into the aqueous.

The effectiveness of the substances which act on the pupil used in therapy in intra-ocular inflammation depend on the mode of application, on special changes in the eye and the functional condition of the sympathetic nerve, in the sense that with the limiting of the function of the sympathetic the blood and the aqueous barrier to the investigated substances is relatively removed.

One can dispense with the supposition of a sensitization of the sympathetic, innervated intra-ocular muscles after degeneration of the sympathetic nerve of the eye in the explanation of the nature of the so-called epinephrine reaction.

SWELLING OF THE VITREOUS HUMOR. DR. E. LOBECK, Heidelberg.

In touching on the problem of glaucoma, the speaker also investigated the question whether the healthy vitreous humor increases in volume through the small changes of its actual reaction. For this purpose, vitreous was taken from the eyes of pigs and put in a glass chamber, which was closed above by a porous tinted plate, and below by a quicksilver reservoir which communicated with a horizontal glass capillary on the same level as the quicksilver mirror of the glass chamber. Through the porous tinted plate the actual reaction of the vitreous changed, and this change was determined colorimetrically. (The artificial change was so carried out that up above on the tinted plate a small glass cylinder was cemented in which was put fluid of determined p_H content [5.4; 7.2; 9.9].) The reaction of the vitreous was changed as much as it might be in life.

After a twenty-four hour interval of investigation, the volume of the vitreous on the alkali side increased about 4 per cent more than the original volume, on the acid side only about 1 per cent. The increase in volume was shown by the forward movement of the thread of quicksilver in the horizontal glass capillary. If the reaction of the vitreous was not changed the volume remained nearly constant.

It was thus proved that the vitreous of the eye of a pig was increased in volume mainly on the alkali side because of slight change in its actual reaction.

The results of the experiment give no information whether such changes also take place in life and in human beings in certain conditions of the eye; whether it can have the same effect on the volume of the vitreous under the influence of tension of the eye as in the experiment when tension was absent, and whether a relationship to tension exists.

On the basis of the facts established by this experiment, it is clear than an increase of tension which is of long duration can only develop when through increase of the volume of the vitreous the iris is pressed so far forward that it leads to a flattening of the anterior chamber and a displacement of the main exit for the fluid in the angle of the chamber, since without this occurrence to which eyes with congenital shallow anterior chamber are disposed, each increase in the volume of the vitreous is offset by the outflow of aqueous to Schlemm's canal so that an increase in intra-ocular tension cannot develop. If it were possible to prove that in glaucomatous eyes with increased tension an abnormal actual reaction leading to swelling of the vitreous is present, then one must be certain first to determine the cause of the glaucomatous increase in tension — that is, of the events which lead to a thickening of the eye through displacement of its exit pores. If the proof is furnished that this swelling of the vitreous with respect to change in the actual reaction in the eye is not secondarily a sequel of the increased tension, but is a primary factor, this is improbable according to investigation made thus far of the blood of patients suffering from glaucoma in relation to its actual reaction.

NEW CLINICAL AND PHYSIOLOGICOCHEMICAL OBSERVATIONS IN PATIENTS SUFFERING FROM GLAUCOMA. DR. A. PASSOW, Munich.

Passow reported determinations of basal metabolism in forty-eight patients with primary glaucoma. In 83 per cent, the basal metabolism was increased. In fifty-one patients, the iodine metabolism was studied; a hyperiodemia was found in 84 per cent of the serums examined. It was further determined that of thirty-three patients, 48 per cent showed an increase of vasoconstriction material in which the great probability of epinephrinemia appeared. This was also indicated by the amount of blood sugar, which was increased or still remained within the normal limits; the blood showed an increase in erythrocytes and mononuclear leukocytes. Earlier investigations showed that the amount of choline, which is antagonistic to epinephrine, was often lowered in cases of glaucoma. From the evidence at hand, it can be said that there is a positive relationship between primary glaucoma and thyrotoxicosis, and it can also be determined that a sympatheticotonic stigmatization is present in the glaucomatous patient. This was also indicated by the deficiency in the test of the epinephrine function, the manner of reaction of the cutaneous glands and the observations of the mineral metabolism. The amount of calcium was slightly increased, and that of potassium was decreased, so that an uncommonly low potassium-calcium quotient existed.

As a result of these observations, important conclusions as to the treatment of glaucoma can be drawn. Thyroxin preparations, iodine and all preparations which cause an increase in metabolism are prohibited. On the contrary, one should seek a dietetic and compensating addition therapy that will restore the equality of the mineral and hormone metabolism which has been broken. The spontaneous and marked lowering of the blood pressure and of the intra-ocular pressure after the intravenous injection of choline into the veins of the ear of a rabbit is shown by a curve. A choline preparation (5 mg. tablets, up to 40 mg. a day) is recommended for testing the lowering of the blood and intra-ocular pressure in primary glaucoma, a vagomimetrically effective means which in previous experiments gave good results.

Book Reviews

AN ANALYSIS OF THE CONSUMPTION OF TOBACCO AND ALCOHOL IN CASES OF TOBACCO AMBLYOPIA. From Annals of Eugenics, Volume II. Part 3: General Discussion, by C. H. Usher, M.D. Part 4: Detailed Statistical Discussion, by Ethel M. Elderton. Pp. 44. London: Cambridge Univ. Press, October, 1927.

In part 3, the author first draws attention to the fact that tobacco amblyopia occurs even in those who have smoked extremely small quantities of tobacco. The amount of tobacco consumed by patients with tobacco amblyopia is compared with the quantity consumed by smokers who do not show evidences of tobacco amblyopia. A study of 1,100 patients with tobacco amblyopia was made to ascertain the quantity of tobacco and alcohol consumed. A controlled series was obtained of 500 pipe smokers whose sight was not affected by tobacco. Tobacco amblyopia was observed most frequently in persons from 51 to 60 years of age, next in those from 41 to 50. Before and after these age groups, the number of cases diminished greatly. A minority of patients less than 51 years of age smoked more tobacco than the general public of the same age; it cannot be maintained, however, that the majority of persons with tobacco amblyopia smoke to excess.

The constituent of tobacco which causes the amblyopia is not known. It is assumed that the quantity of nicotine contained in the tobacco is important. Various tobaccos were analyzed, and the percentage of nicotine present seemed to vary between 1.82 and 3 per cent. The tobaccos used by the great majority of smokers with tobacco amblyopia were those containing the higher percentage of nicotine.

The importance of the alcohol habits of the individual has also been studied. It was found, contrary to common belief, that in nearly all cases of amblyopia there was an overindulgence in alcohol, as well as an excessive use of tobacco. Symptoms of tobacco amblyopia did not reappear in drinkers of alcohol who abstained absolutely from the use of tobacco.

The question of tobacco amblyopia in women was also taken up, although the investigations were not so extensive as in the case of men. The observation was made that amblyopia was caused by a much smaller quantity of tobacco in a woman than in a man. The quantity was, on an average, less than half of that smoked by either the nonamblyopic pipe smoker or by the man with tobacco amblyopia.

Evidence in two cases discouraged the belief that bright light influenced the production of a central scotoma in tobacco amblyopia.

The conclusions were as follows:

1. As a rule patients with tobacco amblyopia are not heavy smokers, and they do not use tobacco to excess. Although 2.85 ounces is the average consumption of tobacco for men of all ages with tobacco amblyopia, and 2.72 ounces is the average of the male smoker who is not amblyopic, yet, after 50 years of age the amblyopic smoker actually smokes less tobacco than the nonamblyopic smoker; the average amount of tobacco smoked by the former is 2.56 ounces and by the latter 2.60

ounces. Moreover, as the age at which tobacco amblyopia appears is more often over 50 than below it, it may be stated that the majority of patients with tobacco amblyopia smoke rather less tobacco than the nonamblyopic persons.

2. It is not true that in nearly all cases of tobacco amblyopia there is overindulgence in alcohol. Rather more than two thirds of the patients drink no more than one glass of beer or whisky daily; included among these are 112 who abstain totally from alcohol.

3. In women a much smaller quantity of tobacco is sufficient to cause amblyopia than in men.

4. The age at which tobacco amblyopia occurs is more frequently above than below 50 years.

5. Evidence provided by the series of cases in this paper does not favor the assumption that bright light has an influence on the production of central scotoma in patients with tobacco amblyopia.

A list of 111 literary references completes the first part.

Part 4 contains the report of the analyses of samples of tobacco, and a statistical study on the age distribution of the patients, on the amount of tobacco smoked, on the occupations of the patients and other interesting features.

Interesting observations are added as to the average amount of drinking at different ages and the amount of drinking compared to the amount of tobacco consumed.

The summary and conclusion of the second part are as follows:

1. The amount of smoking necessary for the development of tobacco amblyopia varies considerably with the subject.

2. Men who were 50 years of age or over when they were found to have tobacco amblyopia were smoking on the average the same amount of tobacco as men of the same age in the control series. Those less than 50 were smoking more tobacco when they developed the disease than those in the control series. The heaviest smokers first sought medical aid when they were about 45 years of age; the most moderate when they were about 55.

3. The control series did not show that excessive smoking in itself will cause tobacco amblyopia. There is evidence, however, that when a tendency to the disease is present, heavier smoking may hasten the age at which the onset occurs.

4. This material did not contain evidence that men who developed tobacco amblyopia worked in a brighter light than the ordinary population.

5. The strength of the tobacco, as judged by the amount of nicotine, does not seem to be of importance; those who smoked the stronger types of tobacco were found in the same proportion among the patients as among the general public, and there is no evidence that they developed amblyopia at an earlier age.

6. The heavier drinkers among those affected with amblyopia are the younger men. Further investigations are needed before drinking is proved a factor in the development of tobacco amblyopia. In the group studied, however, roughly one fourth of the number of men affected were practically total abstainers from alcohol.

7. Drinking and smoking are associated to a slight extent. The person who is most moderate in the one indulgence is usually moderate in the other. This slight association is due partly to the correlation of both these habits with age.

LICHTBEHANDLUNG IN DER AUGENHEILKUNDE. By A. BIRCH-HIRSCHFELD and W. HOFFMAN. Price, 12 marks. Pp. 112, with 34 illustrations. Berlin: Urban & Schwarzenberg, 1928.

The authors, who studied the effect of light on the eye for more than ten years at the Königsberg Clinic, are enthusiastic advocates of phototherapy. A short chapter deals with the physics of light and the absorption of light by the ocular media. Theories of the general and local effects of light are discussed. The short ultraviolet ray (300 to 200 microns) exerts a marked bactericidal effect on all organisms. This effect is increased by the presence of so-called "sensitizers" in the tissues, dyes such as rose-bengal and fluorescein.

Recent studies with capillary microscopy show dilatation of the subepithelial capillaries and subsequent exudation following irradiation of the skin.

The eye differs from other parts of the body in that light may penetrate into its deeper parts in which too great a dosage of light may cause lesions. Hence, phototherapy must not be undertaken without precautions against possible damage to the lens and retina. The retina is protected against the short ultraviolet ray by its absorption in the lens and cornea. The visible rays between 760 and 400 microns, however, reach the retina, in which photochemical changes are produced.

Experimentally, Birch-Hirschfeld produced changes in the ganglion cells by ultraviolet irradiation in aphakic rabbits, and central chorioretinitis by visible rays in eyes with intact lenses. In the anterior segment, intense inflammation is set up unfiltered light which is rich in ultraviolet rays, but this can be prevented, as Birch-Hirschfeld shows, by a filter of uviol glass.

So far it has proved impossible to produce cataract experimentally by ultraviolet light alone. The authors do not believe that there is danger of this in phototherapy, if the ultra-fed light is removed by filters. The advantages of the various methods employing phototherapy are discussed in detail. Methods which depend on visible and long ultraviolet rays, such as Passow's method of using the Hammer lamp with rose-bengal dye, are effective only in ulcerative corneal processes, when the sensitizing dye can come in contact with the tissues and break up the light into shorter rays. For the short ultraviolet rays, the carbon arc, and mercury vapor arc have been used. In the apparatus of Birch-Hirschfeld a filter of uviol glass retains the dazzling visible rays and part of the infra-red rays, the remainder being removed by a quartz cell containing 0.5 per cent copper sulphate. When this apparatus is used with alternating current, 10 amperes should be used, whereas with direct current, 5 amperes give the same amount of light. The authors describe a large and small model of this apparatus made by Zeiss; also the smaller arc lamp of Leitz, made for microscopy but fitted with uviol filters and quartz lenses for irradiation, and costing only about fifty dollars.

The carbon arc lamps may also be used for ophthalmoscopy by red-free light. The authors believe that with the carbon arc the dosage may be regulated more easily than with the more intense mercury vapor lamps. These lamps, of which that of Kromayer is most used, give a spectrum much richer in short ultraviolet rays practically without infra-red rays, so that filters are not necessary. Shorter irradiations suffice with this apparatus, and it is to be preferred when a bactericidal or destructive effect is wanted.

In a table, the authors give the time required with various lamps to produce an erythema with superficial necrosis of the conjunctiva of the rabbit, which they consider the unit dose. This is ten minutes with the carbon arc and three minutes with iron-cored carbons.

The use of sensitizing dyes in treating patients with corneal ulcers, is described. The value of exact technic is emphasized, and possible errors are brought out which may easily nullify the desired effect of treatment.

Finally, the diseases in which phototherapy is indicated are discussed. In phlyctenulosis and eczema of the lids, general phototherapy is useful but local phototherapy is seldom necessary. It is sometimes of assistance in obstinate blepharitis. In tuberculous conjunctivitis and lupus, the well known good results of treatment with Finsen light are described. The results of its use in trachoma are described. On account of the difficult technic and lengthy treatments, it is considered only practicable in specially equipped clinics.

The authors find the principal indications for phototherapy in diseases of the cornea, and especially in serpent ulcer. In herpetic keratitis the results are good, especially if the epithelium is abraded over the infiltration, and rose-bengal dye is used. The authors report more than fifty cases. In phlyctenulosis, local light treatments are used only in obstinate cases. In marginal ulcers rapid healing follows the treatments.

Reports on the treatment of patients with serpent ulcer by light are given in detail, including the experience of the authors in 471 cases. Only 6.1 per cent of the eyes were lost, which the authors consider a justification for this form of treatment. Not only does light have a bactericidal effect, but the stimulation which it gives to regenerating tissues was thought responsible for the relatively good scars observed; ectatic scars rarely occurred. Much less destruction of tissue was produced than by other methods, such as the cautery. Three rodent ulcers healed under light treatment. Good results were seen in trachomatous ulcers. In episcleritis, especially of tuberculous origin, the lesions cleared up rapidly. The authors did not confirm reports of good results in the clearing of corneal scars, nor did they draw definite conclusions favorable to the use of light in tuberculous iritis, as results varied.

Although the authors are undoubtedly enthusiastic on the subject of phototherapy, the wealth of material on which their experience is based and the fact that they have in most cases avoided other treatment which would confuse their judgment of results give their conclusions great weight. The care with which the technic of treatment is discussed makes this monograph extremely valuable to any ophthalmologist who is undertaking phototherapy.

LIDPLASTIK UND PLASTICHE OPERATIONEN ENDERER WEICHTEILE DES GESICHTS. By PROF. JOSEF IMRE. Price, 24 marks. Pp. 95, with 258 illustrations. Budapest: Studium, 1928.

This book, with 258 illustrations, is essentially an atlas of the author's cases in which plastic operations were employed. A number of these operations were for war injuries and a larger number for tumors of the lids and conjunctiva. Besides excellent halftones showing the original lesions and the results obtained, numerous schematic drawings of the author explain the technic. In a brief introduction, certain principles of plastic surgery are outlined. Whenever possible, the defect should be covered with skin from its immediate neighborhood, which, on account of color and texture, gives a better cosmetic result than free transplants. The texture of the skin must be considered. In young persons with well developed subcutaneous fat, the flaps may be made much larger than in old persons with little fat. When deep defects are present, flaps including a thick layer of fat, or sliding flaps of fat from the surrounding region are much better than free grafts of fat, which are prone to necrosis and which, if they survive, shrink considerably.

The author has found a pointed and a rounded double-edged knife especially convenient for dissecting the flaps. He insists on early removal of stitches, beginning on the third day with the removal of every third or fourth stitch, and removing all stitches by the fifth day. This leaves the stitch wounds practically invisible. Irradiation with the Alpine Sunlamp for four or five minutes is given at the time of every dressing. This is believed to hasten healing and stop small areas of necrosis from spreading.

Free grafts are used when most of the face has lost its epithelium or occasionally when an upper lid can be replaced by a whole skin graft. Although the author uses pedicled flaps in the usual way in certain cases, he favors the use of large sliding flaps of the surrounding skin, with wide subcutaneous dissection. His method of using a large semilunar flap with the point fashioned to cover defects of any shape and of excising a triangle near the base of the flap to prevent puckering has been used by other Hungarian surgeons and is sometimes called the Hungarian method. The excellent results attainable with it are shown in numerous illustrations. The round defect can be covered conveniently only by this method. The author points out the defects of other procedures, such as the commonly used Dieffenbach operation which he never employs.

For replacing the tarsus and conjunctiva, Blascovics' procedure of using the conjunctiva and tarsus from the upper lid is useful. When skin and tarsus must be replaced, Budinger's method of using a free graft of skin and cartilage from the helix of the auricle has given good results. The printing of the photographs is excellent. Enough detail is shown by these and the diagrams to show clearly the exact mode of attack in the individual cases, each of which, as in all plastic cases, presents a problem in itself.

THE SPRINGTIME OF PHYSICK, BEING A DIVERTING OUTLINE OF MEDICINE AND SURGERY. BY DR. LAURANCE D. REDWAY. Cloth. Price, $2. Pp. 68. New York: Int. J. of Surg. Co., 1928.

There have been few men actively engaged in the practice of medicine who were also first rate humorists. This is especially true of ophthalmologists, because about nine tenths of their time is engaged in examinations like the following:

Doctor.—"Well, madam, why have you come to consult me this morning?"

Patient.—"My eyes."

D.—"Yes, madam, you know I do nothing but eye work, so it would naturally be your eyes. What is your complaint?"

P.—"No complaint, just my eyes."

D.—"But what trouble are you having with your eyes?"

P.—"No trouble. I want them examined."

D.—"But, madam, there must be some reason why you wish to have them examined—some symptoms."

P.—"Ten years ago a physician told me—"

D.—"Madam, I am not interested in what was told you ten years ago. What is your complaint now?"

P.—"Well, when I was a young girl, I got glasses at a department store—"

D.—"Never mind that, madam. Why do you come to me today?"

P.—"I couldn't come yesterday."

D.—"Oh well, never mind. Do you see that card across the room? Please read the smallest line of letters on that card that you can read."

P.—"I can't read the smallest."

D.—"I didn't ask you to read the smallest, but the smallest that you can read."

P.—"But I can't read the smallest."

D. (Weakly)—"Madam, I give up. It takes just about half a day to read the entire card, and it isn't at all necessary, but I am going to cover your left eye with this card and ask you to look at the card across the room. Begin with the large letter 'E' at the top and read the entire card from top to bottom."

P.—"With my left eye?"

Under such conditions, how is it possible for any eye man to write a really humorous book? Yet Dr. Redway, who is an ophthalmologist, has done just that. It is doubtful that his patients are of a higher order than those inflicted on the ordinary ophthalmologist. (Dr. Redway is attending ophthalmologist at Sing Sing Prison, Ossining, New York.) "The Springtime of Physick" is an excellent "take off" on the writings of Aesculapius, Hippocrates and Galen. Its humor is original and delightfully subtle. There are sixty-nine pages, comprising nine chapters and a "Vermiform Appendix."

Directory of Ophthalmologic and Otolaryngologic Societies *

FOREIGN

OPHTHALMOLOGICAL SOCIETY OF THE UNITED KINGDOM

Time: April 11-13, 1929.

OXFORD OPHTHALMOLOGICAL CONGRESS

Master: Dr. A. B. Cridland, Salisbury House, Chapel Ash, Wolverhampton, England.
Secretary: Dr. C. G. Russ-Wood, 12 St. John's Hill, Shrewsbury, England.
Place: Oxford, England. Time: July 4-5, 1929.

INTERNATIONAL

INTERNATIONAL CONGRESS OF OPHTHALMOLOGY

President: Dr. E. Treacher Collins, 17 Queen Anne St., London, England.
Secretary: Dr. E. Mark, Academisch Zickenhuis, Leyden, The Netherlands.
Place: Amsterdam. Time: Sept. 5-13, 1929.

NATIONAL

AMERICAN MEDICAL ASSOCIATION, SECTION ON OPHTHALMOLOGY

Chairman: Dr. Edward B. Heckel, Jenkins Arcade Bldg., Pittsburgh.
Secretary: Dr. William C. Finnoff, Imperial Bldg., Denver.
Place: Portland, Ore. Time: July 10-12, 1929.

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. Harris P. Mosher, 828 Beacon St., Boston.
President-Elect: Dr. William H. Wilder, 122 S. Michigan Ave., Chicago.
Executive Secretary: Dr. William P. Wherry, Medical Arts Bldg., Omaha.

AMERICAN OPHTHALMOLOGICAL SOCIETY

President: Dr. Walter R. Parker, David Whitney Bldg., Detroit.
Secretary: Dr. Emory Hill, 501 E. Franklin St., Richmond, Va.
Place: Hot Springs, Va. Time: June 10-12, 1929.

LOCAL

SECTION OF OPHTHALMOLOGY AND OTOLARYNGOLOGY OF THE LOS ANGELES COUNTY MEDICAL SOCIETY

President: Dr. Harold S. Muckleston, 6422 Hollywood Blvd., Los Angeles.
Secretary-Treasurer: Dr. J. Frank Friesen, 1208 Roosevelt Bldg., Los Angeles.

---

* Secretaries of societies are requested to furnish the information necessary to make this list complete and to keep it up to date.

SECTION ON OPHTHALMOLOGY AND OTO-LARYNGOLOGY OF THE MEDICAL SOCIETY OF THE DISTRICT OF COLUMBIA

Chairman: Dr. Walter A. Wells, 1606 20th St. N. W., Washington.
Secretary: Dr. J. N. Greear, Jr., 1740 M St. N. W., Washington.
Place: 1718 M St. N. W. Time: 8 p. m., third Friday of each month.

ATLANTA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. Arthur J. Fort, Medical Arts Bldg., Atlanta, Ga.
Secretary: Dr. Leon E. Brawner, 157 Forrest Ave. N. E., Atlanta, Ga.
Place: Academy of Medicine, 38 Prescott St. N. E. Time: 8 p. m., last Thursday of each month.

INDIANAPOLIS OPHTHALMOLOGICAL AND OTO-LARYNGOLOGICAL SOCIETY

President: Dr. Lafayette Page, Hume-Mansur Bldg., Indianapolis.
Secretary: Dr. Kenneth L. Craft, Hume-Mansur Bldg., Indianapolis.
Place: University Club. Time: 6:30 p. m., second Thursday of each month from October to May.

NEW ORLEANS OPHTHALMOLOGICAL AND OTOLOGICAL SOCIETY

President: Dr. M. Earle Brown, Maison Blanche, New Orleans.
Secretary-Treasurer: Dr. W. A. Wagner, Pere Marquette Bldg., New Orleans.
Place: Eye, Ear, Nose and Throat Hospital, New Orleans. Time: 8 p. m., third Thursday of each month from September to June.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

President: Dr. W. Holbrook Lowell, 82 Commonwealth Ave., Boston.
Secretary-Treasurer: Dr. E. B. Dunphy, 520 Commonwealth Ave., Boston.

THE KANSAS CITY EYE, EAR, NOSE AND THROAT SOCIETY

President: Dr. T. S. Blakesley, Lathrop Bldg., Kansas City, Mo.
Secretary: Dr. A. E. Eubank, Argyle Bldg., Kansas City, Mo.
Time: Third Thursday of each month from September to May. The November, January and March meetings are devoted to clinical work.

OMAHA AND COUNCIL BLUFFS OPHTHALMOLOGICAL AND OTOLARYNGOLOGICAL SOCIETY

President: Dr. Donald Owen, Medical Arts Building, Omaha.
Secretary: Dr. Sanford R. Gifford, Medical Arts Building, Omaha.
Place: Medical Arts Tea Room. Time: 5:15 and 7:00 p. m. Third Wednesday of each month from October to May.

ACADEMY OF MEDICINE OF NORTHERN NEW JERSEY, SECTION ON EYE, EAR, NOSE AND THROAT

Chairman: Dr. Lee W. Hughes, 1019 Broad St., Newark.
Secretary: Dr. Earle LeRoy Wood, 31 Lincoln Park, Newark.
Place: 91 Lincoln Park South. Time: 8:45 p. m., second Monday of each month.

BROOKLYN OPHTHALMOLOGICAL SOCIETY

President: Dr. Robert M. Rogers, 680 St. John's Place, Brooklyn.
Secretary: Dr. William F. C. Steinbugler, 515 Ocean Ave., Brooklyn.
Place: Kings County Medical Society Bldg., 1313 Bedford Ave., Brooklyn.
Time: Third Thursday of February, April, May, October and December.

EASTERN NEW YORK EYE, EAR, NOSE AND THROAT ASSOCIATION

President: Dr. M. S. Lord, 148 Barrett St., Schenectady.
Secretary-Treasurer: Dr. Arthur F. Holding, 142 Washington Ave., Albany.

SECTION ON OPHTHALMOLOGY, NEW YORK ACADEMY OF MEDICINE

Chairman: Dr. B. Samuels, 57 W. 57th St., New York.
Secretary: Dr. T. B. Johnson, 30 W. 59th St., New York.
Time: 8:30 p. m., third Monday of every month.

THE OPHTHALMOLOGICAL AND OTO-LARYNOLOGICAL SECTION OF THE CLEVELAND ACADEMY OF MEDICINE

Chairman: Dr. A. B. Brunner, Guardian Bldg., Cleveland.
Secretary: Dr. A. L. Stotter, 1148 Euclid Ave., Cleveland.
Place: Winton Hotel. Time: Fourth Friday of each month.

THE PITTSBURGH OPHTHALMOLOGICAL SOCIETY

President: Dr. Edward B. Heckel, Jenkins Arcade Bldg., Pittsburgh.
Secretary: Dr. George H. Shuman, Park Bldg., Pittsburgh.

THE PITTSBURGH SLIT-LAMP SOCIETY

President: Dr. W. W. Blair, 121 University Pl., Pittsburgh.
Secretary: Dr. George H. Shuman, Park Bldg., Pittsburgh.

OREGON ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. Joseph L. McCool, 909 Stevens Bldg., Portland.
Secretary: Dr. Andrew J. Browning, 418 Mayer Bldg., Portland.
Place: Good Samaritan Hospital. Time: Third Tuesday of each month.

PACIFIC COAST OTO-OPHTHALMOLOGICAL SOCIETY

President: Dr. Robert R. Hampton, Boston Bldg., Salt Lake City.
Secretary-Treasurer: Dr. Walter F. Hoffman, 817 Summit Ave., Seattle.
Place: Salt Lake City. Time: July 1-3, 1929.

SECTION ON OPHTHALMOLOGY, COLLEGE OF PHYSICIANS, PHILADELPHIA

Chairman: Dr. C. E. G. Shannon, 17th and Walnut St., Philadelphia.
Clerk: Dr. L. F. Appleman, 308 S. 16th St., Philadelphia.
Time: Third Thursday of every month.

THE MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

Chairman: Each member, in alphabetical order.
Secretary: Dr. R. O. Rychener, Exchange Bldg., Memphis, Tenn.
Place: Eye Clinic of Memphis Eye, Ear, Nose and Throat Hospital. Time: 8 p. m., second Tuesday of each month.

DALLAS ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. John G. McLaurin, Medical Arts Bldg., Dallas, Texas.
Executive Secretary: Dr. W. Mood Knowles, Medical Arts Bldg., Dallas, Texas.
Recording Secretary: Dr. L. M. Sellers, Medical Arts Bldg., Dallas, Texas.
Place: Dallas Athletic Club. Time: 6 p. m., first Tuesday of each month from October to June. The November, January and March meetings are devoted to clinical work.

FORT WORTH EYE, EAR, NOSE AND THROAT SOCIETY

President: Dr. C. P. Schenck, Medical Arts Bldg., Fort Worth, Texas.
Secretary-Treasurer: Dr. R. H. Needham, Fort Worth National Bank Bldg., Fort Worth, Texas.
Place: University Club. Time: 6:30 p. m., first Friday of each month except July and August.

EYE, EAR, NOSE AND THROAT SECTION OF THE HOUSTON ACADEMY OF MEDICINE

President: Dr. John H. Foster, 1300 Walker Ave., Houston, Texas.
Secretary: Dr. Edward W. Griffey, Houston Clinic, Houston, Texas.
Place: Medical Arts Bldg., Harris County Medical Society Rooms. Time: 8 p. m., first Thursday of each month from September to June.

THE SAN ANTONIO OPHTHALMOLO-OTO-LARYNGOLOGICAL SOCIETY

President: Dr. F. H. Roseborough, 302 Moore Bldg., San Antonio, Texas.
Secretary-Treasurer: Dr. William D. Gill, 323 Medical Arts Bldg., San Antonio, Texas.
Place: Bexar County Medical Library, San Antonio, Texas. Time: 8 p. m., first Tuesday of each month from October to May.

THE MILWAUKEE OTO-OPHTHALMIC SOCIETY

President: Dr. L. P. Allen, 145½ Main St., Oshkosh, Wis.
Secretary-Treasurer: Dr. Edward R. Ryan, 425 E. Water St., Milwaukee.
Place: University Club. Time: 6:30 p. m., third Tuesday of each month.

THE ARCHIVES OF OPHTHALMOLOGY is published by the American Medical Association to continue the Archives of Ophthalmology founded by Herman Knapp in 1869, and to provide American ophthalmologists with a publication devoted not only to original contributions in the field of ophthalmology, but to a survey of ophthalmic literature and a review of the transactions of ophthalmic societies.

Manuscripts for publication, books for review, and correspondence relating to the editorial management should be sent to Dr. Arnold Knapp, 19 East 54th Street, New York. Communications regarding subscriptions, reprints, etc., should be addressed, ARCHIVES OF OPHTHALMOLOGY, American Medical Association, 535 North Dearborn Street, Chicago.

Articles are accepted for publication on condition that they are contributed solely to the ARCHIVES OF OPHTHALMOLOGY. Manuscripts must be typewritten, preferably double spaced, and the original copy should be submitted. Zinc etchings and halftones of illustrations will be supplied by the Association when the original illustrations warrant.

Footnotes and bibliographies should conform to the style of the Quarterly Cumulative Index Medicus, published by the American Medical Association. This requires, in order given: name of author, title of article, name of periodical with volume, page, month—day of month if weekly—and year. A complete list of abbreviations for standard periodicals, together with a full discussion of the style of the A. M. A. publications, appears in The Art and Practice of Medical Writing, a comprehensive book on the preparation of medical manuscripts, published by the American Medical Association. Price, $1.50.

Matter appearing in the ARCHIVES OF OPHTHALMOLOGY is covered by copyright, but, as a rule, no objection will be made to its reproduction in reputable medical journals, if proper credit is given. However, the reproduction for commercial purposes of articles appearing in the ARCHIVES OF OPHTHALMOLOGY, or in any of the other publications issued by the Association, will not be permitted.

Authors will receive one hundred reprints free; additional reprints may be obtained at cost.

The ARCHIVES OF OPHTHALMOLOGY is issued monthly. The domestic, annual subscription price (two volumes) is $8.00; Canadian, $8.40; foreign, $8.75, including postage. Single copies, 85 cents.

Checks, etc., should be made payable to the American Medical Association.

OTHER PERIODICAL PUBLICATIONS

of the American Medical Association

THE JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION—Weekly. Covers all the medical sciences and matters of general medical interest. Illustrated. Annual subscription price (two volumes): Domestic, $5.40; Canadian, $6.50; foreign, $7.50. Single copies, 25 cents.

ARCHIVES OF INTERNAL MEDICINE—Monthly. Devoted to the publication of advanced, original clinical and laboratory investigations in internal medicine. Illustrated. Annual subscription price (two volumes): Domestic, $6.00; Canadian, $6.40; foreign, $6.75. Single copies, 75 cents.

ARCHIVES OF NEUROLOGY AND PSYCHIATRY—Monthly. A medium for the presentation of original articles on nervous and mental diseases, with abstracts from foreign and domestic literature, book reviews, society transactions, etc. Illustrated. Annual subscription price (two volumes): Domestic, $8.00; Canadian, $8.40; foreign, $8.75. Single copies, 85 cents.

AMERICAN JOURNAL OF DISEASES OF CHILDREN—Monthly. Presents pediatrics as a medical science and as a social problem. It includes carefully prepared collective abstracts based on recent pediatric literature, abstracts from foreign and domestic literature, book reviews, society transactions, etc. Illustrated. Annual subscription price (two volumes): Domestic, $5.00; Canadian, $5.40; foreign, $5.75. Single copies, 75 cents.

ARCHIVES OF SURGERY—Monthly. Devoted largely to the investigative and clinical phases of surgery, with monthly reviews of orthopedic and urologic surgery. Well illustrated. Annual subscription price (two volumes): Domestic, $8.00; Canadian, $8.40; foreign, $8.75. Single copies, 85 cents.

ARCHIVES OF DERMATOLOGY AND SYPHILOLOGY—Monthly. Devoted to advancing the knowledge of and progress in cutaneous diseases and syphilis. Publishes original contributions and full abstracts of the literature on these two subjects, transactions of the important dermatological societies, book reviews, etc. Illustrated. Annual subscription price (two volumes): Domestic, $8.00; Canadian, $8.40; foreign, $8.75. Single copies, 85 cents.

ARCHIVES OF OTOLARYNGOLOGY—Monthly. A medium for the presentation of original articles on diseases of the ear, nose and throat, with abstracts from foreign and domestic literature, book reviews, the transactions of special societies, etc. Illustrated. Annual subscription price (two volumes): Domestic, $6.00; Canadian, $6.40; foreign, $6.75. Single copies, 75 cents.

ARCHIVES OF PATHOLOGY—Monthly. A periodical devoted to the publication of original contributions in the field of pathology, with abstracts from foreign and domestic literature, book reviews, the transactions of special societies, etc. Illustrated. Annual subscription price (two volumes): Domestic, $6.00; Canadian, $6.40; foreign, $6.75. Single copies, 75 cents.

QUARTERLY CUMULATIVE INDEX MEDICUS—Quarterly. A complete subject and author index to the worth-while current medical literature of the world. Issued four times a year. Second and fourth volumes bound for permanent reference. Subscription price, calendar year: Domestic, $12.00; Canadian, $13.60; foreign, $13.75.

AMERICAN MEDICAL ASSOCIATION

CONTENTS

PAGE

The Nutrition of the Lens and of the Vitreous. Henry Smith, C.I.E., Sidcup, Kent, England 159

Cyst of the Uveal Layer of the Iris at the Pupillary Margin in a Case of Posterior Synechiae with Secondary Glaucoma. W. H. Wilmer, M.D., Baltimore 162

Meningiomas Arising from the Tuberculum Sellae with the Syndrome of Primary Optic Atrophy and Bitemporal Field Defects Combined with a Normal Sella Turcica in a Middle-Aged Person. (Concluded.) Harvey Cushing, M.D., and Louise Eisenhardt, M.D., Boston 168

Interstitial Keratitis with Unusually Marked Chorioretinitis: Pathologic-Anatomic Examination of a Case. W. P. Ling, M.D., Peking, China 207

Disklike Degeneration of the Macula, with Microscopic Report of a Tumor-Like Mass in the Macular Region. T. B. Holloway, M.D., Philadelphia, and F. H. Verhoeff, M.D., Boston 219

The Regeneration of the Aqueous Humor. Peter Clemens Kronfeld, M.D., Vienna, Austria 231

Obituary:

Lucien Howe, M.D. 241

Notes and News 243

Abstracts from Current Literature 245

Society Transactions:

The New York Academy of Medicine, Section of Ophthalmology 261

Royal Society of Medicine, London, Section on Ophthalmology 263

The German Ophthalmological Society 265

Book Reviews 299

Directory of Ophthalmologic and Otolaryngologic Societies 303